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Effect of High School Completion of the Agricultural Education Program on the Rate of Return on Investment for the Commonwealth of Virginia

Phillip Scott Bevins
Old Dominion University

EFFECT OF HIGH SCHOOL COMPLETION OF THE AGRICULTURAL EDUCATION PROGRAM ON THE RATE OF RETURN ON INVESTMENT FOR THE COMMONWEALTH OF VIRGINIA

by

Phillip Scott Bevins
B.S., May 1985, The University of Virginia's College at Wise
M.S., August 1991, University of Tennessee

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Approved by:

John M. Ritz (Director)

Philip A. Reed (Member)

Ginger S. Watson (Member)

ABSTRACT

EFFECT OF HIGH SCHOOL COMPLETION OF THE AGRICULTURAL EDUCATION PROGRAM ON THE RATE OF RETURN ON INVESTMENT FOR THE COMMONWEALTH OF VIRGINIA

P. Scott Bevins
Old Dominion University, 2010
Director: Dr. John M. Ritz

This research study sought to determine the effect high school completion of the agricultural career and technical education program has on the rate of return on investment by public schools in Virginia. The research questions guiding this study included: (1) Were students able to find employment related to the agricultural career and technical education program they completed, (2) What federal and state funding was allocated for students participating in the agricultural career and technical education programs in the state of Virginia, (3) Was there a significant level of tax revenues generated by incomes from those who participated in the agricultural career and technical education program, (4) Did incomes from those who participated in the agricultural career and technical education program vary among statewide planning districts, and (5) Did completion of the high school agricultural career and technical education program produce a return on investment for the Commonwealth of Virginia?

The population used for this study consisted of 9,145 high school completers of Virginia's agricultural career and technical education programs from 2001 to 2007. The data collected on the completers were obtained from student responses to a post-graduation survey administered by the Virginia Department of Education. The remaining data used in the study included state and federal funding for the agricultural career and technical education program in Virginia, incomes of the agricultural career and technical

education completers, and incomes of additional laborers resulting from industry expansion and tax revenue generated from that income.

The research findings of this study indicated that investing in Virginia's agricultural career and technical education program has had a positive impact on economic activity within the agricultural industry, as well as within non-agricultural industries inside and outside the state. The researcher's estimate of total benefits (the sum of income tax and sales tax revenue) exceeded the estimate of total cost (the state and federal funding allocated to the school divisions across the state) only when including estimates of income and sales tax revenues from projected additional laborers resulting after industry expansion. Such expansion produced a positive return on investment of 24%.

DEDICATION

This dissertation is dedicated to my lovely wife, Becky, and my two beautiful daughters, Sierra and Ally. Their love, support, and understanding made my dream of completing a doctorate a reality.

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My life has been very blessed with supportive family and loved ones and exceptional instructors, colleagues, and mentors throughout my years of education and employment. My parents, Pat and Cyle, neither of whom attended college, stressed the importance of an education from the beginning of primary school. It was never a question of whether I would go to college, but where. They taught me not only to appreciate an education, but also to take pride in my work, both in school and in the workforce. They stressed the importance of character and integrity. Although I may not have always understood and/or agreed with their reasoning as a child and through the teenage years, I have since realized how much gratitude I owe them for their love, teaching, and support.

Moving into undergraduate school, I must acknowledge four instructors who taught me a great deal and inspired me to push myself to succeed. Two were economics' instructors, Dr. Peter Yun and Dr. Jim Canipe. When I first met them, I was majoring in mathematics, but through their lively lectures, I discovered a place I could apply my mathematics skills. After the first class, I knew that was what I wanted to pursue. While I never had the other two instructors for a class, their teachings were just as valuable. Mr. Bill Lee, an accounting and business instructor, and Dr. George Culbertson, former Chancellor and Provost and my first boss at The University of Virginia's College at Wise, continue to inspire me today with their words of wisdom about business, politics, higher education, and life in general. I consider all four of them as friends and colleagues and continue to keep in touch today.

After completing my undergraduate degrees in mathematics and business, I was fortunate to be placed with another exceptional advisor and faculty mentor at the University of Tennessee in the Agricultural Economics' Department. Dr. Kim Jensen was a great advisor, teacher, and researcher. She was very giving of her time and was always willing to include me in research opportunities.

Now, I would like to move to the present. I was officially accepted into the doctoral program in Fall 2006. However, I actually took my first class under Dr. Ritz in Summer 2006. I think my enrolling in Dr. Ritz's "thesis writing" class (voluntarily) was a testament of my interest in the program. Needless to say, I thoroughly enjoyed the class and knew that I really wanted to enroll in the program. I could not say enough about how Dr. Ritz has mentored me along the way. He was always willing to advise and assist me at any time. It did not take me long to realize from his actions and those of other faculty in the department that they truly wanted students to succeed, but not just finish a degree. They wanted students to be contributors to the profession. In addition to Dr. Ritz, I have to extend my thanks to Dr. Reed and Dr. Watson. I completed four classes under Dr. Reed and really enjoyed all of them. Of course, if I were to pick my favorite, I would have to choose the "economic trends." Although I have not had the pleasure to enroll in one of Dr. Watson's courses, as a member of my dissertation committee, she has assisted me with valuable insight and advice throughout the writing of my dissertation. Because of Drs. Ritz, Reed, and Watson, I have developed a love and fascination for the technology education profession and discipline.

Another individual to whom I owe many thanks is Dr. Gil Blackburn, Provost and Senior Vice Chancellor at The University of Virginia's College at Wise and my current

supervisor. From the moment I first mentioned the program, he has given his unwavering support. In the years that I have worked under him, I have grown to see him as a true friend and mentor. He has taught me a lot about higher education, leadership, and administration. I am pleased that I have the opportunity to defend my dissertation in June, his last month prior to retirement. I will always remember his support and encouragement.

Finally, I must thank my wife Becky and daughters, Ally (age 11) and Sierra (age 12), for it is they who have put up with me through the good times and the rough times during this program. While I always attempted to forgo sleep rather than time with them, it was not always possible. Regardless, they were always supportive, because just as my parents taught me, I have instilled in Ally and Sierra the importance of an education. I am so very proud of them. I owe much gratitude to Becky, not to mention, some solo parenting, since she has been placed in that situation at many times during the course of this program. I am blessed and fortunate to have the opportunity to love three such wonderful ladies!

P. Scott Bevins

TABLE OF CONTENTS

Page

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

INTRODUCTION

The United States has been a significant player in the world's agricultural market since the eighteenth century (Mancall, Rosenbloom, & Weiss, 2000). The arrival of the "agricultural revolution" in the mid-1800s marked the beginning of her rapid march to dominance in the global agricultural market (Trautman, Porter, & Wagenet, 2007, p. 1). "Over 74 percent of the U.S. labor force was employed in the farm sector in 1800, and the share was even higher in the preceding century" (Mancell, Rosenbloom, & Weiss, 2000, p. 1). In 1800, 94% of the total U.S. population lived in rural America, with 1,261,239 working in agriculture, 66% of those as free workers, and 34% as slave workers (Craig & Weiss, 1998). "Today less than 2% of the population is engaged in farming" (U.S. Embassy in Japan, 2007, p. 1). Such a dramatic decrease in the labor required in agricultural production may be attributed to technological advances and improvements and to a "competitive, capitalistic economic system" (Ikerd, 2008, p. 8). With the existence of competitive conditions in the agricultural market, farmers were driven by the profit motive to industrialize. As a result, productivity increased dramatically over the last two centuries. Since 1948, increased agricultural productivity has predominantly resulted from agricultural research and technology development. Technological developments included "more efficient agricultural machinery, agricultural chemicals and fertilizers, genetic improvements in crops, and changes in farm management techniques" (Caswell & Day-Rubenstein, 2006, ¶ 2). From 1948 to 1993, productivity increased an average of nearly 2% each year (Day & Klotz-Ingram, 2007). Table 1 reveals increases in the growth rates for output indices (using 1996 as the base

year) of livestock and products and crops of 131% and 174%, respectively, from 1948 to 2007. However, growth rates for the input indices (using 1996 as the base year) of capital and labor decreased 16% and 77%, respectively for that same period.

Table 1

Agricultural Output and Input Indices, 1948-2007

	Output / Input Indices		
	1948	1976	2007
Output:			
Livestock & Products	0.49	0.79	1.13
Crops	0.42	0.68	1.15
Input:			
Capital	1.15	1.24	0.97
Labor	3.25	1.35	0.76
Materials	0.46	0.89	1.16

From "Agricultural Productivity in the United States," by the United States Department of Agriculture, 2010. Retrieved from http://www.ers.usda.gov/Data/AgProductivity/table01.xls.

Agricultural Industry in Virginia

How have the aforementioned historical transformations in U.S. agriculture impacted Virginia's agricultural sector? In 1800, 16% of the U.S. population resided in Virginia, with 277,660 working in agriculture, 405 as free workers and 166,596 as slave workers (Craig & Weiss, 1998). Today, the agricultural industry has the largest

economic impact of any industry in Virginia, generating $55 billion and 357,100 jobs (Rephann, 2008). According to Rephann from University of Virginia's Weldon Cooper Center for Public Service (2008), "every job created in agriculture and forestry results in another 1.5 jobs in the Virginia economy, and every dollar generated in value-added results in another $1.75 value-added in the Virginia economy" (p. 1). Virginia's 47,600 farms consist of 60,000 farmers and laborers, generating $3 billion in the production of commodities. Industries using the commodities as inputs in the production of other goods yield another 76,000 jobs and $26 billion in total output. Another 221,000 positions and approximately $26 billion results from industries related to the agricultural sector (Virginia Department of Agriculture & Consumer Services, 2008).

Since the beginning of colonization in this nation, the U.S. has witnessed vast improvements in technology and productivity of both labor and capital. Regardless of downturns in the economy at times, economic growth has always trended upward, as evidenced by increases in the standard of living or per capita real gross domestic product (GDP). From 1960 to 2005, per capita real GDP increased from $15,640,000 to $43,267,000 (2005 U.S. dollars) or 176.6%. Only Norway's per capita real GDP, $49,606, exceeded that of the U.S. in 2005 (U.S. Department of Labor, 2008). With such vast changes in technology and shifts in productivity, the U.S. has acknowledged a need to increase agricultural technological literacy.

With the current state of the economy, consumers are faced with higher prices for food and gasoline, both of which are economic necessities. Since 1999, the consumer price index for food has risen 30.5% and for gasoline, 177.2%, demonstrating a need for increased agricultural literacy and agricultural technological literacy (Bureau of Labor

Statistics, 2008). Agricultural and agricultural technological literacy are essential for finding cheaper production alternatives which could result in lower prices and improved quality to the consumer. Forty-two percent of the global population earns a living from the agricultural sector (FAO, 2004). "This is all the more reason to make food, fiber, environment and natural resources systems the context upon which we build our education efforts to create social and personal relevance of science and technology in the global community and create multidimensional literacy about food, fiber, environment, and natural resources systems" (Cardwell, 2004, p. 4).

Content Standards

At present, content standards for agricultural education are being driven by the National Council for Agricultural Education (The Council). The Council, established in 1983, "provides leadership, coordination and resources for the total educational process in career and technical education involving career awareness, exploration, and preparation in agriculture for pre-K through adult including teacher education and supervision" (The Council, 2008, p. 2). The National Council for Agricultural Education (The Council) has formed a task force to develop agricultural curriculum standards in line with the "Agriculture, Food and National Resources Career Cluster and the seven pathways" (The Council, 2009, ¶10). In the meantime, agricultural course content and thus, instruction are being influenced by the *States' Career Clusters Initiative*, by Virginia's *Standards of Learning*, and by the International Technology Education Association's (ITEA, 2002) *Standards for Technological Literacy.* The career clusters are: *Agriculture, Food, and Natural Resources*; *Architectural and Construction*; *Arts, A/V Technology and Communication*; *Business Management and Administration*; *Education*

and Training; *Finance*; *Government and Public Administration*; *Health Science*; *Hospitality and Tourism*; *Human Services*; *Information Technology*; *Law and Public Safety, Corrections, and Security*; *Manufacturing*; *Marketing*; *Science, Technology, Engineering, and Mathematics*; and *Transportation, Distribution, and Logistics*. Students choosing the *Agriculture, Food, and Natural Resources* cluster must demonstrate skills in the following areas in order to succeed: academic foundations; communications; problem-solving and critical thinking; information technology applications; systems; safety, health, and the environment; leadership and teamwork; ethics and legal responsibilities; employability and career opportunities; and technical skills (SCCI, 2008). The Department of Education in Virginia has requested that each of the public school divisions construct career pathway plans of study for all 16 clusters. To date, 79 plans of study or career pathways have been established under the clusters. Seven plans of study have been developed under the *Agriculture, Food, and Natural Resources* cluster: *Agribusiness Systems*; *Animal Systems*; *Environmental Service Systems*; *Food Products and Processing*; *Natural Resources Systems*; *Plant Systems*; and *Power, Structural, and Technical Systems* (Virginia Department of Education, 2009).

Although Virginia's *Standards of Learning* do not consist of a test or an assessment instrument devoted entirely to agriculture, some agricultural concepts are addressed on the science and the social sciences tests. Secondary students are responsible for concepts such as cell theory, plants, animals, ecosystems, and conservation under the "life sciences" portion of the science test. For the economics' section of the social science test, students must develop an understanding of economic development, conservation, scarcity, resources, cost-benefit analysis, supply and demand, economic

systems, types of business ownership, government intervention, banking, and globalization (Virginia Board of Education, 2008). According to the *2002 Standards for Technological Literacy*, "students will develop an understanding of and be able to select and use agricultural and related biotechnologies" (ITEA, 2002, p. 149). After successfully completing primary school or grades K-5, students will have an understanding of how technologies have made food more readily available each year and of how technologies have advanced the conservation of resources. Students will have an introductory understanding of what is meant by the "ecosystem." After middle school, grades 6-8, student comprehension will consist of returns-to-scale, that is, technologies' impact on required labor and inputs in comparison to output; specialized machinery and methods; the meaning of biotechnology; artificial ecosystems; and food processing. During high school, grades 9-12, teachers will have covered agriculture as an input or factor of production for other businesses, the applications of biotechnology, greater detail on conservation, and agriculture systems (ITEA, 2002).

In addition to *Standards for Technological Literacy* (ITEA, 2002), Virginia adapted her high school agricultural curriculum to a very vibrant agricultural career and technical education program with the intent of meeting today's technological and industry needs. In 1909, Virginia's high school curriculum for agriculture included one course taken each year beginning with the ninth grade and extending through the twelfth. The courses included: *Agriculture I – The Plant and Soil, Agriculture II – Soil and Crops, Agriculture III – Farm Animals and Dairying,* and *Agriculture IV – Farm, Home, and Local Agriculture* (Sutphin, 1999). Today, Virginia's high school students have five agricultural education programs from which to choose: *horticulture, agricultural*

business, natural resources management, agricultural machinery, and *production agriculture.* Emphasis is placed on all facets of "agricultural businesses and industries" (Virginia Department of Education, 2007). Courses may be selected from fundamental courses, such as *agricultural mechanics and basic plant science or basic animal science; agricultural business; agricultural power; agricultural production; natural resources management; horticulture; biotechnology program;* and specialized courses, such as *biotechnology, biological applications, equine management and production, animal care, veterinary science, small engine repair, turf grass, farm equipment operator, leadership,* and *agricultural education for the disadvantaged or disabled* (Virginia Department of Education Career & Technical Education, 2008). Students have three possible sequences in agricultural education: "(1) a concentration requiring a coherent sequence of courses completed in a specific career, (2) a specialization in which case the student specializes in an occupational field by taking additional courses in a specific career area, and (3) a career and technical education completion program where the student fulfills the requirements for a career and technical concentration or specialization while also completing all requirements for high school graduation or an approved alternative education program" (Russell, E. (Virginia Department of Education), 2008, p. 21). Virginia saw the annual number of "student completers" increase from 1,123 to 1,451 or 29 percent from 2001 to 2005 (Center for Assessment, 2002 & 2006). While the number of completers has increased significantly, expenditures on the agricultural career and technical education program have increased as well, raising public and legislative concern about the return on the monies allocated for the program.

Statement of the Problem

The purpose of this study was to determine the effect high school completion of the agricultural career and technical education program has on the rate of return on investment by public schools in Virginia.

Research Questions

To guide this study, the following research questions were established:

1. Were students able to find employment related to the agricultural career and technical education program they completed?
2. What federal and state funding was allocated for students participating in the agricultural career and technical education programs in the state of Virginia?
3. Was there a significant level of tax revenues generated by incomes from those who participated in the agricultural career and technical education program?
4. Did incomes from those who participated in the agricultural career and technical education program vary among statewide planning districts?
5. Did completion of the high school agricultural career and technical education program produce a return on investment for the Commonwealth of Virginia?

Background and Significance

Although the U.S. made significant technological advances in the seventeenth century, "many leaders believed the U.S. was in danger of being left behind by what they considered more advanced countries of Europe" (Herren & Edwards, 2002, p. 91). As a result of such concern and the effort to prevent a substantial gap between the educated wealthy class and the more common citizenry, the Morrill Land-Grant College Act of 1862 was enacted. The Act sought to establish a university (by providing land grants) in

each state. At the conclusion of the Civil War, such institutions began to emerge across the U.S. with the mission of providing agricultural education. With technological growth came the need for increased knowledge, knowledge of agricultural tools, and production processes appropriate for existing climate and soil (Herren & Edwards, 2002). However, the land-grants soon discovered that students enrolling in their agricultural courses had not been adequately prepared for that level of education (Sutphin, 1999). As a result of the inadequate preparation, "a movement was made for secondary agricultural education. Hence, the movement for Congressional district agricultural schools began" (Sutphin, 1999, p. ii). Additional events contributing to the expansion of the agricultural knowledge base included the Hatch Act of 1887 and the Smith-Lever Act of 1914 which created agricultural experiment stations and the Cooperative Extension Service (Herren & Edwards, 2002). The Smith-Hughes Act of 1917 put the remaining component in place to facilitate the discovery of new and improved agricultural processes and machinery and for the dissemination of such discovery information to America's farmers. The Act of 1917 "enacted legislation that formalized the need for systematic post-secondary preparation of agriculture teachers, instructors who would teach secondary level agriculture" (Herren & Edwards, 2002, p. 94). Although agriculture could be found in high school curriculum before 1917, the Act of 1917 formalized vocational teacher preparation in land-grant institutions (Herren & Edwards, 2002).

While there has been a great deal of historical research on agriculture in the United States, as well as the state of Virginia, there has been no research investigating the return on investment for Virginia's high school agricultural career and technical education programs. The results of this study would be valuable to the state in its overall

strategic planning process and would show how other career and technical education programs could contribute financially to the economy.

Limitations

The limitations of the study were as follows:

1. Generalizations of the findings were limited to the Commonwealth of Virginia.
2. In determining the rate of return on educational investment in Virginia, the study did not account for differences in race, gender, age, or learning disabilities.
3. The rate of return on educational investment was based on the agricultural career and technical education completer's employment one year after graduation. Inferences cannot be made beyond that year.
4. Tax revenue and federal, state, and local funding were limited to governmental policies and/or legislation in place for each respective year.
5. The rate of return on educational investment did not reflect the total costs of the program. Federal and state allocations, including Perkins' monies and equipment entitlements, were only included, as opposed to teachers' and staff salaries and fringe benefits, costs for infrastructure, such as buildings and facilities and the operational costs of those.
6. Indirect effects or third-party externalities from agricultural production and employment, were not addressed in this study.

Assumptions

The assumptions of the study were as follows:

1. The agricultural career and technical education program was assumed to be of the same quality and to have included the same offerings from 2001 to 2007.
2. It was assumed that return on investment could be calculated for career and technical education programs.
3. Federal and state allocations were assumed to have been distributed equally across all programs, and thus completers.
4. Rephann's model (2008) was assumed to be accurate in projecting the creation of additional labor as the agricultural industry expands.

Procedures

The data sought were found in annual follow-up reports completed by Virginia's Secondary Career and Technical Coordinators for completers of the agricultural career and technical education program. A follow-up report was completed in each district across the state, consisting of descriptive information regarding incomes and student demographics, student perceptions of the program, such as his/her preparedness for employment, and his/her current employment status. This information was collected by Virginia Tech. In addition, federal, state, and local funding per district was obtained from the Virginia Department of Education.

The data will be analyzed using three methods or approaches. Descriptive statistics will provide mean, frequency, and standard deviation for each survey response. Kirkpatrick's (1995) evaluation approach will be used to identify the benefits of the agricultural CTE program at levels 1 through 3 and the return on investment at level 4.

The total benefit and total cost of the agricultural CTE program will be estimated and used to calculate an estimate of the return on investment.

Definitions of Terms

The following items are defined to assist the reader:

- An "agricultural career and technical education completer" is a high school student who has completed two or more agricultural career and technical education courses.
- "Federal, state, and local funding" includes Perkins' monies and equipment monies allocated to the school divisions.
- A "planning district" is a geographic region within the state consisting of one or more counties and one or more cities for the purpose of "promoting orderly and efficient development of economic, physical, and social elements of the region" (Mount Rogers Planning District Commission, n.d., ¶ 1).
- "Return on investment" refers to the net benefit generated from $1 of investment.

Overview of Chapters

In Chapter I, information was presented on the purpose of the research study and the problem of determining the effect high school completion of the Agricultural Career and Technical Education program has on the rate of return on investment for public education. In addition, the problem limitations, assumptions, and definitions were provided. The remainder of the study will consist of the *Review of Literature, Methods and Procedures, Findings, and Summary, Conclusions, and Recommendations.* The *Review of Literature* will include research studies pertaining to the history of agricultural

education, secondary agricultural education, agricultural career and technical education in Virginia, and return on investment in the public sector. *Methods and Procedures* will detail how the data for the study were collected and analyzed using descriptive statistical analysis and the formula for calculating return on investment. In addition, assumptions and limitations for the analyses will be included. The *Findings* will consist of summaries of the results from the analyses and return on investment. Lastly, *Summary, Conclusions, and Recommendations* from the research findings will be addressed in the last chapter.

CHAPTER II

REVIEW OF LITERATURE

Chapter II, the Review of Literature, provides a historical account of the evolution and importance of agricultural and career and technical education and an account of how return on investment has been used to assist in decision-making in the public sector and specifically in employee training. A distinction is made between agricultural education and vocational education, while mapping the historical transition from vocational education to career and technical education. In addition, a review of previous research regarding return on investment illustrates the measure's usefulness in determining viability of an existing program or project. Once the case for using the return on investment measure is made and the historical account for agricultural education, vocational agriculture, and career and technical education is provided, justification for the research problem and goals becomes clear.

Agricultural and Career and Technical Education

The United States has demonstrated phenomenal economic growth and development since Columbus first visited. At that time, the U.S. population consisted of approximately 370,000 Native Americans inhabiting a land rich in untapped natural resources (Campbell, 1995). Although settlers following Columbus met many hardships, such as disease and lack of food, perseverance soon won out. During their demonstration of perseverance, the nation witnessed many technological discoveries and improvements along the way. Initially, unlike today, such discoveries and improvements were driven by the need to survive. The settlers had to adjust and adapt to a new environment to continue their existence. As a result, English and European tools and production

processes were adapted to differing surroundings and environmental circumstances, such as land and climatic conditions (Heilbroner & Singer, 1999). While such adaptations were necessary, the settlers also realized the important role of church and education.

> As soon as they started a new settlement, these stalwart pioneers typically demonstrated their abiding faith in community life by building a school and a church. They sincerely believed that a firm foundation in education and religious values would enable their children and grandchildren to live happier, healthier, more productive lives (Campbell, 1995, ¶ 4).

In fact, the church often drove education and its curriculum content, as illustrated by the Puritans' move to America in order to evade religious harassment from the Church of England. Their strong focus on God influenced their entire way of life, including the education of their children (Kizer, n.d.). The birth of agricultural education did not come until 300-400 years later with the Morrill Acts of 1862 and 1890. Vocational agriculture did not enter legislatively until the Smith-Hughes Act of 1917 (Humboldt, 2007).

Agricultural Education and Vocational Agriculture

> In a sense, of course, all human communities, no matter how industrialized, live off the soil: All that differentiates an "industrial" society from an "agricultural" one is the number of the nonagricultural population that its food growers can support (Heilbroner & Milberg, 2001, p. 16).

> The history of vocational education is inseparable from the history of man. The problems of primitive man centered about the task of getting food, seeking shelter and protecting himself from a particular environment. In

> man's efforts to conquer his physical environment, skill and knowledge to perform specific tasks have been transmitted from generation to generation (Ekstrom, 1969, p. 15).

The agricultural sector reflected the aforementioned historical economic growth through increased capital and labor productivity resulting from the advancement of new and improved agricultural technology. The technological changes were made possible by increased research and education (Bishop & Tolley, 1963). Prior to the American Revolution, agricultural education was found only in "schools for orphans or in missionary schools" (Moore, 1987, p. 2). The objective was to instill in students an understanding of how best to secure a living through agricultural production (Moore, 1987). After the American Revolution in the late 1700s, the focus on agriculture began to expand more quickly as the elite realized the best "vehicle" for economic expansion and prosperity was agriculture. America's entrepreneurs and political leaders directed their focus on "agricultural, industrial, commercial, political, and social interests" (True, 1929, p. 1). Agriculture touched most, if not all, aspects of society. The agricultural sector expanded through not only traditional means of farming, but also through the involvement of skilled craftsmen, of business entrepreneurs and professionals, and of former military members. Skilled craftsmen often took part in farming in addition to their areas of specialization. Many of the entrepreneurs and professionals living in the relative few cities existing at that time directed their excess monies toward land speculation and agricultural related business activities. Former soldiers of the Revolutionary War frequently chose to move westward beyond the borders of the original colonies, thus resulting in the clearing and cultivating of new land. As the population

moved westward, the demand for new transportation, communication, and agricultural technologies grew (True, 1929). As the nation's emphasis on agriculture increased, so too did her emphasis on "commerce, manufactures, and the arts," demonstrating the need for "agricultural research and education" (True, 1929, p. 1).

Initially, progress was very slow, but as was done during the Revolutionary War when the militia was in dire need for monetary aid in financing the War, the colonists turned to ideas they had brought with them from the mother country. They created the nation's first bank, the Bank of North America. In regards to agriculture, Great Britain had been very successful in achieving rapid growth, in large part through advances in "crop rotations and the breeding of better livestock" (Fletcher, 1976, p. 10). Individuals of influential stature in the U.S. were well-aware of the success and accomplishments achieved by farmers in Great Britain and were thus, intent on seeing America follow in her footsteps and as a result, began developing "agricultural societies" which played a significant role in promoting and guiding agricultural techniques, growth, and production before the establishment and spread of agricultural education programs and curriculum across the country.

New agricultural ideas, processes, and techniques grew out of such organizations as the American Philosophical Society (APS), led by Benjamin Franklin in 1743; the Philadelphia Society for the Promotion of Agriculture (PSPA), founded in 1785 by agricultural-interested members from the American Philosophical Society; the Agricultural Society of South Carolina (ASSC), formerly known as the South Carolina Society for Promoting and Improving Agriculture and Other Rural Concerns, established in 1785; and the United States Agricultural Society (USAS), developed and located in

Washington, DC, in 1852. Such organizations were instrumental in providing a foundation from which the academicians at all levels of education could build. Their success, however, was not a given, instead dependent upon their ability to prove their usefulness to scientists and other members of society. The APS focused on the study of the natural world, engaging in research that would be classified as "scientific and technological" by today's standards. "The leading object was to obtain suggestions upon a variety of subjects, hints, observations, and experiments, that they might be examined, discussed, and the knowledge of them extended, with the view of leading to important discoveries" (Daly, 1863, p. 10). "Membership, consisting of doctors, lawyers, clergymen, and merchants, encouraged America's economic independence through improved agriculture, manufacturing, and transportation" (APS, 2009, ¶3). Membership in these early organizations included the affluent of America, because they possessed the natural and financial resources necessary for assessing new discoveries and processes (Fletcher, 1976). Their work in "astronomical observations" led to their international recognition as true academic scholars (APS, 2009). Their work and discoveries were to have been enhanced by a vast network of communications and by conducting regularly scheduled meetings where agricultural experiments and technological discoveries could be analyzed for their accuracy, validity, and usefulness. The work of this organization and of those that followed was instrumental in providing information benefiting society from the perspectives of the producer through augmented production processes, the worker through labor-saving innovations, and the consumer through new and improved conveniences (Daly, 1863).

The PSPA has existed longer than any other agricultural association in the nation. Since the organization's beginning, members have sought to address societal issues that have often had both economic and political implications (Baatz, 1985; Fletcher, 1976). At that time, Philadelphia was the focal point of new ideas in agricultural production and technological improvements. America had just gained her independence from Great Britain, and citizens were eager to create a nation where individuals could succeed and prosper. Accomplishing this objective pointed them to the oldest, "most honorable" industry in the history of the world, agriculture (Fletcher, 1976; State Agricultural Society of South Carolina (SASSC) & State Agricultural & Mechanical Society of South Carolina (SAMSSC), 1916). While the Philadelphia organization assisted in driving the expansion of agriculture in the U.S. through the mid-1800s through advances made in crop rotation and soil fertility, many historians argue the organization's contributions during the early years were less significant because of the existing attitudes between the "working farmer" and the elites serving in the group. At times during the first three to four decades of the organization's presence, the disparity resulted in purely "academic" solutions that, to the farmer, appeared to be unrealistic with their own understanding. While such controversy existed, the group's impact on agricultural growth and development and on academic research could not be denied and included such contributions as crop rotations which increased grass production, leading to an increase in livestock production and in the renewal of soil and in the utilization of gypsum, leading to the use of lime for increasing soil fertility (Fletcher, 1976). Examples of their research included the Hessian fly, a destroyer of wheat in the late 1700s, and the nation's battle with tuberculosis in the early 1900s (Baatz, 1985).

State agricultural organizations evolved more quickly as the Philadelphia Society for the Promotion of Agriculture's influence spread. Initially, organizations were established in multiple agricultural areas across respective states, and then eventually leading to state-wide associations, as in the case with South Carolina. After the establishment of the Agricultural Society of South Carolina (ASSC) in the city of Charleston, there were twelve individual associations across the state. Prior to the Civil War there were in excess of 900 agricultural associations or societies in the U.S. (Carrier, 1937). The ASSC was created "for the encouragement of agriculture in the State, and the promotion of the arts and sciences contributing thereto" (SASSC & SAMSSC, 1916, p. XIX). As a means of promoting and advancing state and national agriculture, agricultural societies produced exhibitions or fairs. State legislatures soon realized the importance of the fairs and work of the societies and began to appropriate monies for the societies; New York being the first in 1819. Roughly 20 years later, states had developed a network for pushing agriculture on a national level (Lyman, 1937). "Nearly all of the States had State agricultural societies or boards of agriculture" and were advocating for the formation of a "national agricultural board" (Lyman, 1937, p. 279). As a result, the United States Agricultural Society was established "from a resolution passed by the Massachusetts State Board of Agriculture which was endorsed by eleven similar boards" (Lyman, 1937, p. 279). The United States Agricultural Society was instrumental in the passing of two key pieces of agricultural legislation, the Land Grant Act which led to the development of agricultural institutions in higher education and the legislation establishing the United States Department of Agriculture (Lyman, 1937).

During the second year of the Civil War, the Morrill Act of 1862 was approved for the provision of public land to states in the amount of 30,000 acres per senator and congressman. However, each state was to sell the public land and use the earnings to create one land grant institution to offer curriculum/programs pertaining to agriculture and mechanical arts (NAP, 1995). The Morrill Act of 1890 provided additional funding to the states to be used as payment "for instruction in agriculture, mechanical arts, the English language and branches of mathematics, physical, natural and economic sciences related to agriculture and mechanical arts" (NAP, 1995, Table 1-2). The turn of the century witnessed a dramatic increase in the demand for agricultural education, as evidenced by the 360% increase (10,000 to 46,000) in boys' involvement in corn clubs from 1909 to 1910 (Ekstrom, 1969). With the demand for agricultural education increasing at the elementary and secondary levels, the demand for qualified educators escalated. Between 1900 and 1917, agriculture teachers were prepared in one of two ways: they were trained in regular colleges in which case they received little agriculture preparation or in schools of agriculture where little emphasis was placed on "professional courses" (Ekstrom, 1969). Links between agricultural education and the land grant institutions gradually evolved after the passage of the Act of 1862. The Nelson Act of 1907 permitted land grant colleges to direct part of their appropriated monies toward preparing "teachers of agriculture and mechanic arts" (Ekstrom, 1969, p. 9). The Smith-Hughes Act of 1917 was in large part the result of many states choosing not to participate in permitting land grants to reallocate a portion of their monies toward such teacher preparation (Ekstrom, 1969).

The Smith-Hughes Act of 1917 put the remaining component in place to facilitate the discovery of new and improved agricultural processes and machinery and for the dissemination of such discovery information to America's farmers. The Act of 1917 "enacted legislation that formalized the need for systematic post-secondary preparation of agriculture teachers, instructors who would teach secondary level agriculture" (Herren & Edwards, 2002, p. 94). Most of the teacher education programs established in the land grant institutions after the passage of the Act of 1862 continue to be housed there today (Herren & Hillison, 1996). The Act of 1917 marked the beginning for agricultural departments and vocational teacher preparation in land-grant institutions (Herren & Edwards, 2002, p. 94).

As a result of the Smith-Hughes Act, a Federal Board for Vocational Education was established. The Board managed the allocation of federal grants for vocational education and were heavily involved in the training of men for military enrollment and in the retraining of disabled men returning from wartime service, a result of the Smith-Sears Act of 1918 (Prosser, 1918). During the first year of the act's passage, the Board's policies enclosed all parts of vocational education "in the states for agriculture, trades and industries, and home management" (Prosser, 1918, p. 264). The Board's authority included overseeing the development and implementation of vocational courses and the distribution of federal monies (Prosser, 1918).

Table 2 illustrates the transformation of agricultural education from 1890 to the present. Agricultural curriculum focused mainly on crops, animals, and their production processes and the agricultural economy during the late 1800s and early 1900s. There was no emphasis placed on the "business" side of agriculture or farming. Management and

leadership courses came later. In fact, Crocheron noted in 1916 that "manual training courses in the school do not train mechanics, home economics courses do not train housekeepers, nor do agricultural courses train farmers. Agricultural courses specialized in tiny gardens and never got out to the fields and farms" (p. 79).

Table 2

Comparison of High School Agricultural Curriculum

1890 High School Agricultural Curriculum	1909 Virginia High School Agricultural Curriculum	Virginia High School Agricultural Curriculum Today
Agronomy	Agriculture I – The Plant & Soil	Horticulture Sciences
Zootechny	Agriculture II – Soil & Crops	Agricultural Production Management
Dairying	Agriculture III – Farm Animals & Dairying	Operating the Agriculture Business
Rural Engineering	Agriculture IV – Farm, Home, & Local Agriculture	Leadership Development
Rural Economy		Intro to Natural Resources
		Forestry Wildlife & Soil
		Natural Resource Business
		Farm Equipment Operator
		Agricultural Biology
		Turfgrass Management

From Moore, G. & Borne, C. (1985). *The Secondary Vocational Agriculture Curriculum from 1890 to 1980.* Retrieved from http://pubs.aged.tamu.edu/jae/pdf/vol27/27-03-08.pdf and Sutphin, C. (1999) *History of Virginia congressional district agricultural high schools* (Doctoral dissertation, Virginia Polytechnic Institute and State University, 1999).

Agricultural experiment stations played an integral part in the transformation of agricultural education in the public schools. "The Office of Experiment Stations started an active campaign in different parts of the country to promote the introduction of agriculture into secondary and elementary schools around the turn of the century" (Moore, 1988, p. 3). In October 1888, the Office of Experiment Stations (OES) was formed as a distinct branch of the United States Department of Agriculture. The OES conducted teacher training and provided them with classroom materials, such as the *Farmers' Bulletins.*

The Renewable Resources Extension Act of 1978 "provided a Congressional mandate strengthening the capability of the Department of Agriculture's Cooperative Extension Service, land grant universities, and cooperating counties to work with renewable resources, including fish, wildlife, and water resources, on private forest and range lands" (U.S. Fish & Wildlife Service, 2007, p. 1). As a result, natural resources and wildlife found their way into today's high school agricultural curriculum, as shown in Table 3. In addition to natural resources, today's curriculum includes turfgrass management, leadership, and greater emphasis on agri-business.

Agricultural Education at the Secondary Level

Presently, agricultural education is plagued with two serious problems: too few agriculture teachers graduating from postsecondary institutions across the nation and and too many high school agriculture teachers choosing to exit their secondary careers early in pursuit of other interests (Myers, Dyer, & Washburn, 2005). As a result of such problems, agricultural education programs in postsecondary institutions have failed to meet the demand with an adequate supply of qualified and effective secondary teachers.

The percentage of agricultural education programs offering teacher preparation has decreased 4 percentage points since 1995. According to Camp et al. (1998), roughly 94 percent of the 84 agricultural education programs offered teacher education programs.

Table 3

Volatility in the Supply of Secondary Agriculture Teachers

	N	Min	Max	Range	Mean	Median	Standard Deviation
Teaching positions	31	5,959 (2002)	12,844 (1978)	6,885.0	10,761.13	10,846.5	1,611.74
Unfilled vacancies	24	8 (1985)	221 (1977)	213.0	67.81	41.0	61.76
New teachers	31	588 (1989)	1,791 (1978)	1,203.0	964.39	789.0	370.27
Percentage of those new teachers not entering teaching	24	40.8 (1985)	73.0 (2004)	32.2	54.01	53.2	8.71

From "The National Study of the Supply and Demand for Teachers of Agricultural Education from 2004-2006," by A. Kantrovich, 2007. Retrieved from http://aaaeonline.org/files/supplydemand07.pdf.

Whereas today, approximately 90 percent of the agricultural programs housed in institutions of higher education concentrate on preparing future teachers (Myers & Dyer, 2004). However, excess demand for agricultural education teachers is not new to the market. Kantrovich (2007) revealed dramatic volatility in the number of newly qualified secondary agriculture teachers, the number of total teaching positions, the number of

unfilled vacancies, and the percentage of those qualified who chose to enter the teaching field in 1964-65 and from 1977 to 2006, as shown in Table 3. Kantrovich (2007) noted unfilled vacancies of 120 in 1965, 8 in 1985, 51 in 1995 and 78 in 2006.

According to Myers and Dyer (2004), postsecondary agricultural institutions must overcome a number of problems that existed in the late 1990s in order to improve the market imbalance. Postsecondary institutions were not vigorously recruiting quality agricultural faculty. Agricultural faculty full-time equivalents were between 0 and 6.12 in postsecondary programs and were predominately provided by white males. Not only have postsecondary requirements for teacher education programs become vastly different across the U.S. in program length and in course offerings and requirements, they have also become misaligned with middle school and high school demands. In addition to industry demands, public school teachers are facing accountability issues from legislatures (Myers & Dyer, 2004). Hence, the teacher must incorporate "curriculum that addresses standards in science, mathematics, and other content areas" so as to ensure student success on upcoming "state mandated standardized tests" (Myers & Dyer, 2004, p. 44).

Today's agricultural system has two primary functions, meeting today and tomorrow's society needs. In addition to society desiring that needs be met with appropriate output, the output is expected to be produced in a more environmentally responsible manner. Previous research illustrates societal concerns for "surface and groundwater contamination, natural resources management, biotechnology application, and food safety" (Williams & Dollisso, 1998, p. 52). As with any content area in career and technical education, curriculum must be adaptable to changes in the U.S. and global

markets. Therefore, additional research should focus on methods of mixing sustainable agricultural content into the high school curriculum more effectively. Historical problems have resulted from the time lag between the curriculum and new agricultural developments and improvements. "Curriculum materials, instructional aids, and innovative approaches to teaching" would help diminish the time lag. The high school agricultural classroom would benefit most from research targeting discovery, integration, application, and teaching (Williams & Dollisso, 1998, pp. 54-55).

Careful review of current demands on a new agriculture teacher provides a much clearer understanding of why recruiting students into the teaching profession is more difficult and a clearer understanding of why those who do enter the profession may stay for only a short period of time. According to Myers, Breja, and Dyer (2004), the classroom teacher is a significant factor for ensuring program success at the secondary level. A successful agriculture teacher

> encourages, counsels, and cares for students; has a sound knowledge of Future Farmers of America (FFA), actively advises the FFA chapter, and effectively prepares students for Career Development Events (CDE); has knowledge of classroom subject matter; and effectively determines students' needs, plans for instruction, and evaluates students; well organized and has excellent time management skills; uses a variety of teaching techniques and has knowledge of teaching and learning theory; and has good community relations (Roberts & Dyer, 2004, p. 85).

Such required qualities and skills reveal the difficulty facing post-secondary agricultural education departments. Those post-secondary departments must have the ability to

recruit and accept students possessing many of the qualities identified by Roberts and Dyer (2004) or have a teacher education program in place that will provide an environment where those skills are developed. The aforementioned skills and qualities are developed more easily in a teacher education program as a whole, not in an individual required class or two. Within those teacher education programs, teacher participants in a study completed by Park and Rudd (2005) emphasized the need for "positive examples" and good "role models" from post-secondary educators. According to Myers, Breja, and Dyer (2004), agriculture teachers stressed the need to improve the "image" of the secondary agricultural education program and the need to shift curriculum in the direction of science and technology, that is, shift the perception of agriculture from "farming and crop production" to that of a more rigorous science and technology curriculum.

If new teachers have not been prepared appropriately, in-service opportunities must be available; otherwise, they may find themselves very discouraged and unhappy in a very short period of time. "The primary reason for providing seamless and continuing education for beginning teachers is to improve their overall effectiveness and efficiency" (Joerger, 2002, p. 11). According to Joerger (2003), school divisions were inconsistent in the type and quantity of assistance that was provided within their divisions as well as across all divisions. While the types of assistance, such as orientation, mentoring, and classroom materials and activities, were very positive steps, not all teachers received such assistance.

Career and Technical Education

Although vocational agriculture did not enter legislatively until the Smith-Hughes Act of 1917 (Humboldt, 2007), a type of vocational education can be dated to the late

1700s with the introduction of "vocational-type" programs in private schools and academies and the establishment of "shopwork" in higher education (Prakken, 1976). Today, the National Governors Association has targeted career and technical education (CTE) as the means of improving the nation's educational system (primary, secondary, and postsecondary) and of meeting the future innovation needs in the economy. Greater than 50 percent of those students choosing CTE in secondary education are following the college preparatory curriculum (Wakelyn, 2007). Studies have shown that students enrolled in CTE are less likely to drop out due to the content of those classes; that is, students enjoy "real-world" topics and applications. In addition, studies have revealed that student success is directly related to the rigor of the course. Hence, myths of CTE courses requiring less academic skills from students are at last beginning to disappear. More and more states are increasing the graduation requirements and are forming new partnerships and developing new alternatives to provide high school students with greater access to "Advanced Placement courses and dual enrollment" courses (Wakelyn, 2007, p. 1).

Virginia's Career and Technical Programs

Presently, Virginia offers seven career and technical program areas: *agricultural education, business and information technology, family and consumer science, health and medical sciences, marketing, technology education,* and *trade and industrial education.* Courses within these programs are matched to a career cluster or clusters. "A career cluster is a grouping of occupations and broad industries based on commonalities" (VDOE CTE, 2007). The clusters aid students in analyzing careers and in the development of their coursework in pursuit of their career goals. The a*griculture, food,*

and natural resources career cluster provides seven career pathways to students: *food products and processing systems; agribusiness systems; power, structural, and technical systems; animal systems; environmental service systems; plant systems;* and *natural resources systems* (Career & Technical Education, 2007).

The *food products and processing systems* pathway focuses on quality control in the processing of agricultural commodities. In addressing quality control, students learn how to "plan, implement, manage, and/or provide services associated with the preservation and packaging of food products to prepare products for distribution" (National Career Technical Education Foundation (NCTEF-Food Products and Processing Systems Pathway), 2008, p. 24). Such decision-making requires students to be knowledgeable of existing standards from the U.S. Department of Agriculture and from the Food and Drug Administration. In addition, they must be able to apply cost-benefit analysis in determining how best to preserve, package, and distribute food products and commodities (NCTEF-Food Products and Processing Systems Pathway, 2008).

Agribusiness systems encompasses the activities involved in the organization of resources for the production of an agricultural commodity or product with the intent of maximizing profits from the selling of the commodity or product. "Agribusiness is a high-tech industry that uses satellite systems, computer databases and spreadsheets, biotechnology and many other innovations to increase efficiency and profitability" (NCTEF-Agribusiness Systems Pathway, 2008, p. 1). Students successfully completing this pathway will acquire skills in all aspects of management and leadership, including basic accounting and sales and marketing principles. In addition, they will be exposed to

Global Positioning System (GPS) and Geographical Information System (GIS) software applications as well as word processing, presentations, spreadsheets, databases, electronic mail, and Internet research (NCTEF-Agribusiness Systems Pathway, 2008).

Students choosing the *power, structural, and technical systems* career pathway will "apply knowledge of engineering, hydraulics, pneumatics, electronics, power, structures, and controls to the field of agriculture. They will apply physical science principles to engineering applications with mechanical equipment, structures, biological systems, land treatment, power utilization, and technology to facilitate work in the *power, structural, and technical systems*" (NCTEF-Power, Structural, and Technical Systems Pathway, 2008, p. 1). Students will learn how to identify energy sources and how to utilize cost-benefit analysis in determining the source most efficient as a power source. They will gain an understanding of how best to maintain machinery, equipment, and transmission and electrical systems as well as how to construct and utilize technical designs for structural systems. Lastly, students will be able to identify technologies contributing to agricultural production and the impact of such technologies on the industry as a whole (NCTEF-Power, Structural, and Technical Systems Pathway, 2008).

The *animal systems* pathway emphasizes the "development of better, more efficient ways of producing and processing meat, poultry, eggs, and dairy products (NCTEF-Animal Systems Pathway, 2008, p. 1). *Animal systems* addresses all aspects of the production process, from the reproduction process to the development of the animal for market. As a result, students will analyze the impact of new technologies, global regulations, and communication systems on the industry. They will discover ways of improving animal health through the prevention of disease and appropriate or improved

nutrition, key contributors to profit maximization (NCTEF: Animal Systems Pathway, 2008).

Students choosing the *environmental service systems* pathway will be prepared for working "in water and air pollution control, recycling, waste disposal and public health issues and will be able to analyze scientific data, research environmental projects, and perform quality control checks" (NCTEF-Environmental Service Systems Pathway, 2008, p. 1). Students will apply statistical principles and applications to measure operations and ascertain environmental control limits and will apply scientific principles in analyzing weather conditions, soil content, and groundwater supplies for hazards and potential (NCTEF-Environmental Service Systems Pathway, 2008).

The *plant systems* pathway educates students in the study of plants and plant growth in an effort to assist "producers of food, feed, and fiber crops continue to feed a growing population while conserving natural resources and maintaining the environment" (NCTEF-Plant Systems Pathway, 2008, p. 1). As future growth in population continues to rise, a better understanding of crop nutrition, soil fertility, and environmental conditions must be achieved in order to meet the increasing demand for food. With additional knowledge of fertilization, pest management, and harvesting techniques, optimum growth, maximum yield, and maximum profits become possible for the producer (NCTEF-Plant Systems Pathway, 2008).

Students choosing the *natural resources systems* pathway desire to help in "developing, maintaining, and managing the forest and natural environment as well as in catching and trapping various types of marine life for human consumption, animal feed, bait, and other uses" (NCTEF-Natural Resources Systems Pathway, 2008, p. 1). By

definition, a natural resource may be thought of as anything occurring naturally in the environment, such as forests, wildlife and marine life, and rocks, minerals, and oil. Students will learn to identify the different types of natural resources as well as the different species that may exist for a particular type of resource. Increased understanding of the different resources will enable students to identify from a conservationist perspective the most appropriate harvesting techniques and procedures (NCTEF-Plant Systems Pathway, 2008).

While the seven career and technical program areas enable students to select courses that match their career interest, such information does not necessarily ensure courses will be met with increased enrollment. Student recruitment is essential for future growth in agriculture as well as any other career and technical program area. As Gray and Daugherty (2004) revealed, students are more likely to be recruited into career and technical education programs, by high school teachers. "While over 95% of the faculty indicated that they used face-to-face interaction to recruit, only 6% of the students acknowledged that it was used effectively to recruit" (Gray & Daugherty, 2004, p. 17). The authors concluded that high school teachers should be used more for the recruitment of students as opposed to high school guidance counselors (Gray & Daugherty, 2004).

An integral part for curriculum development and recruitment includes the integration of needs assessment into both processes. By conducting needs assessments throughout the processes, information is gathered and may be utilized in making education decisions and curriculum adjustments. "Needs" information is collected "for the procedural development of the program" and can assist in recognizing future implications of the decision-making (Grier, 2005, p. 61). Included in the assessments

should be an analysis of secondary career and technical education instructors' "attitudes, knowledge, and understanding" of their respective program area, as researched by Boone, Boone, and Hughes (2006) in West Virginia. As in West Virginia, the perception of knowledge and the extent of understanding may differ between the researcher or investigator and the instructors themselves. In addition, such analysis may identify societal concerns of agricultural ethics. Foster (2000) revealed that individuals with different educational backgrounds and interests communicated similar concerns regarding ethical agricultural issues. Virtually all of the secondary teachers included in the Delphi study incorporated "ethical" topics into their coursework, regardless of whether they personally viewed them as important to the class content.

As the face of agricultural education shifts with changes in agricultural technology, the structure of the agricultural industry, and the labor market, secondary and post-secondary institutions are met with increasing demands for justification of how public dollars are being used to produce a better educated and more productive citizenry. "University economists and policy analysts are being asked to assist states and institutes of technical education to develop more coherent strategies for development of public occupational training institutes and colleges" (O'Looney, 2001, p. 76).

Return on Investment

> There is a strong consensus among economists that formal education is an important determinant of individual earnings as well as economic growth (Joint Economic Committee, United States Congress, 2000, ¶ 1).

Return on investment (ROI) is very common in the world of business, but it has only become more frequently used in the public sector, specifically public education, in

recent years. With respect to education, the ROI model has been most widely used for evaluating training programs in institutions of higher education. According to Phillips and Phillips (2005), "ROI is the ultimate measure of accountability that answers the question: Is there a financial return for investing in a program, process, initiative, or performance improvement solution" (p. 1)? Closely related to ROI, benefit-cost ratio (BCR) compares only benefits to costs, as opposed to the change in benefits or earnings compared to costs. That is,

$$BCR = \frac{Program\ Benefits}{Program\ Costs}, \text{ and } ROI\,(\%) = \frac{Net\ Program\ Benefits}{Program\ Costs} x100$$

(Phillips & Phillips, 2005, p. 2). While some researchers would argue that calculating the ROI for public education is impossible, an increasing amount of research is illustrating the inaccuracies in such claims. "Almost all training and performance improvement professionals share the belief that they must eventually show a return on investment; otherwise, funding may be reduced, or the function may not be able to maintain or enhance its present status and influence in the organization" (Phillips & Phillips, 2002, p. 2). With the "No Child Left Behind" legislation, came an increase in the demand for institutions to be more accountable; that is, legislators and taxpayers want to see what return, in terms of student success, their money is generating. Public institutions in the U.S. depend on primarily three revenue sources: "state allocation based on enrollment and organizational performance, local taxes, and tuition and fees" (Cardenas, 2007, p. 2). Using a ROI model enables institutions to not only ensure appropriate use of financial resources, but it also allows them to improve their data collection and evaluation processes at all levels of the institutions and from all perspectives, staff, faculty, administration, and students (Cardenas, 2007).

Two evaluation or ROI models dominate as being the most recognized and most used in evaluation research: the "Phillips' five level evaluation framework" and "Kirkpatrick's four level training evaluation model." Table 4 illustrates the similarities and differences between the two evaluation models. Levels 1 through 3 are alike for both models. Phillips and Phillips (2005) separates the results and the impact of the investment, such as on training or an academic program and the results or the ROI.

Table 4

Phillips' and Kirkpatrick's Levels of Evaluation

	Phillips	Kirkpatrick
Level 1	Reaction, Satisfaction, and Planned Action	Student Reaction
Level 2	Learning	Student Learning
Level 3	Application and Implementation	Application of Knowledge and Skills
Level 4	Business Impact	Results (ROI)/Impact
Level 5	ROI	

From Phillips. J. & Phillips, P. (2005). *Return on Investment (ROI) Basics*. Alexandria: ASTD Press and Kruse, K. (n.d.). *Evaluating e-learning: Introduction to the Kirkpatrick model*. Retrieved from http://www.e-learningguru.com/articles/ art2_8htm.

ROI in Training and Technical Programs

"A training evaluation provides evidence of how well training succeeds in achieving objectives, whether and how training can be improved, and whether and to what degree training is cost-effective" (Basarab, 1990, p. 177). The overall objective of

any evaluation process is to see improvement. The ROI model reveals improvement as a monetary value, net benefit in dollars per dollar in total cost.

Since the 1990s, there has been increasing research completed on the usefulness of the ROI model in the public sector (Anderson & Woodill, 2004; Boyle & Crosby, 1997; Brauchle & Schmidt, 2004; Brewer, 2007; Bryson, 1993; Cardenas, 2007; Glover, Long, Haas, & Alemany, 1999; Hood, 2007; Munoz & Munoz, 2000; Russ-Eft & Preskill, 2005). Using a ROI model allows the institution or organization to direct attention on its effectiveness, as opposed to only its efficiency. Kirkpatrick's levels of evaluation assess or evaluate effectiveness of the participants at different levels that in turn provide management or administration insight into productivity and quality improvements resulting from additional training and/or education (Anderson & Woodill, 2004). Kirkpatrick's approach "works well for evaluating the effectiveness of both technical and soft skills training, and it is particularly well suited for evaluating the various quality initiatives and seems equally appropriate for evaluating programs of study at universities" (Boyle & Crosby, 1997, p. 81). Brauchle and Schmidt (2004) concluded that a number of analytical approaches may be used in the "results" level of Kirkpatrick's model, and it would be advantageous for education to strongly consider utilizing those techniques or methods. Possible analytical approaches included benefit/cost ratio, payback period, return on true value of dollars, present value of dollars and future value of dollars, utility analysis, 360-degree feedback, performance team satisfaction, balanced scorecard, human resource development benefit forecasting, relative aggregate scores, and unemployment insurance wage studies (Boyle & Crosby, 1997). However, Brewer (2007) noted that non-profit organizations were primarily evaluating training at levels 1

and 2, reaction and learning, of Phillips' model, providing support for conclusions made by Munoz and Munoz (2000). According to Munoz and Munoz's (2000), the perceived weaknesses of the Phillips' model is, in many cases, poor implementation of the approach by the respective organization. For example, organizations may use inadequate or poorly developed evaluation instruments and/or processes, may include too few variables for measuring output and productivity, may collect data inappropriately, may use inappropriate statistical methods, or may fail to convert all benefits and costs to dollars.

Return on investment, whether used as part of Kirkpatrick's evaluation levels or Phillips' levels, is proving to be more valuable in the public sector. Increased success will be largely dependent upon organizations' thoroughness in addressing all aspects of the activities occurring at each level. All costs and benefits must be included.

Summary

As revealed in the previous research, there has been a great deal of historical research on agriculture in the United States, as well as in the state of Virginia. However, the vast majority of the research has focused on historical accounts of the development of agriculture or agricultural education and curriculum. There has been no research investigating the return on investment to taxpayers for investing in the high school agriculture career and technical education program. Is the result of such allocation of resources across the Commonwealth yielding a positive return? The results of this study would be valuable to the state in its overall strategic planning process and would show how other career and technical education subjects can contribute to the economy.

CHAPTER III

METHODS AND PROCEDURES

A quasi-experimental study was conducted in order to investigate the effect high school completion of the agricultural career and technical education program has on the rate of return on investment by public schools in Virginia. The methods and procedures used in addressing the problem and goals are detailed in this chapter, with data analyses directed by Kirkpatrick's four levels of evaluations. Chapter details will include an explanation of the research variables, population of the study, methods of data collection, statistical analysis, and summary.

Research Variables

The independent variables included: income; tax revenues; consumption; sales tax revenues; additional output; and federal, state, and local expenditures for agricultural CTE programs in Virginia. The dependent variable for the study was return on investment. Monetary values for all variables were adjusted to 2009 dollars and were derived as follows.

Income

Income referred to wages and/or salary earned by the agricultural CTE program completers. There were four wage intervals from which completers could choose in the survey: less than $6.00, $6.00 to $8.99, $9.00 to $12.00, and above $12.00 (Center for Assessment, Evaluation and Education Programming (CAEEP), Virginia, 2001-2007). According to Pat O'Reilly (personal communication, April 8, 2010) from the Center for Assessment, Evaluation, and Educational Programming at Virginia Tech, the lowest wage interval, less than $6.00, "was set to identify those making less or at minimum

wage; the other intervals were established as a matter of convenience, but based upon previous data." Since the wage intervals differed in size, one of which having no upper limit, the minimum possible wage in each interval was used. The national minimum wage was used for those completers indicating a wage of less than $6. For $6.00 - $8.99, $6.00 was used; $9.00 for $9.00 - $12; and $12.01 for those who indicated a hourly wage over $12. The selected wage for each interval was used in calculating total wages, tax revenues, personal consumption, sales tax revenue, and the dollar or market value of additional output. Table 5 displays each wage adjusted to 2009 dollars. Total income was calculated by identifying the number of completers employed; their employment

Table 5

Nominal and Real Wage

		Real Wage						
	Nominal Wage	00-01	01-02	02-03	03-04	04-05	05-06	06-07
2009 Adjustment:		1.21	1.19	1.17	1.14	1.10	1.06	1.03
Real Wages:								
	5.15	6.23	6.13	6.03	5.87	5.67	5.46	5.30
	6.00	7.26	7.14	7.02	6.84	6.60	6.36	6.18
	9.00	10.89	10.71	10.53	10.26	9.90	9.54	9.27
	12.01	14.53	14.29	14.05	13.69	13.21	12.73	12.37

From "CPI Inflation Calculator," by Bureau of Labor Statistics, 2010. Retrieved from http://www.bls.gov/data/inflation_calculator.htm.

description, that is, whether they held full-time (FT) employment, part-time (PT), two or more part-time, or full-time and part-time employment; their work hours per week; and

the number of weeks worked per year. A general representation of the calculation appears as:

$$Income = Number\ of\ Completers \times Hourly\ Wage \times Weekly\ Work\ Hours \times Annual\ Work\ Weeks,$$

where,

wage = 5.15, $6.00, $9.00, or $12.01 per hour; weekly work hours = 40 for FT, 20 for PT, 40 for 2 or more PT, and 60 for FT and PT; and annual work weeks = 50.

Tax Revenue

Income tax revenues were derived by applying the annual tax rate for a single male and female under the age of 25 years to the annual income of each employed completer or laborer. Once the appropriate income bracket for the male or female was identified according to the appropriate year in the Bureau of Labor Statistics' *Consumer Expenditure Survey* (2009), the tax rates were determined by using the before- and after-tax-incomes displayed in the survey. The annual income brackets and tax rates are shown in Table 6.

Consumption

The average propensity to consume (APC), the percentage of household income spent annually, was calculated by using the before-tax income for a single male or female under the age of 25 years, as shown in Table 7, and the corresponding average annual expenditures from the Bureau of Labor Statistics' *Consumer Expenditure Survey* (2009); that is,

$$APC = \frac{Average\ Consumer\ Expenditures}{Before - tax\ Income}$$

Sales Tax Revenue

Sales tax revenues, tax revenues generated from a tax on personal consumption, was calculated by applying a 4.5% tax on consumer expenditures for 2000-01 and a 5% tax from 2001-2007. The 4.5% tax was derived from summing a 3.5% state tax and a 1% local tax in 2000-01 and 4% state tax and a 1% local tax for 2001-07, as reported by the Virginia Department of Taxation (2010).

Table 6

Income Tax Rates by Gender and Year

	00-01	01-02	02-03	03-04	04-05	05-06	06-07
Female:							
Income before Taxes:	12,029	11,573	9,773	9,906	10,741	12,335	13,040
Income after Taxes:	11,557	11,253	9,488	9,667	10,505	11,937	12,535
Tax Rate:	0.0392	0.0277	0.0292	0.0241	0.0220	0.0323	0.0387
Male:							
Income before Taxes:	12,168	12,557	13,014	13,285	13,680	15,043	16,328
Income after Taxes:	11,589	12,068	12,460	12,825	13,313	14,650	15,745
Tax Rate:	0.0476	0.0389	0.0426	0.0346	0.0268	0.0261	0.0357

From "Consumer Expenditure Survey: Cross-tabulated Tables," by Bureau of Labor Statistics. 2009. Retrieved from http://www.bls.gov/cex/csxcross.htm#y20001.

Table 7

Consumer Expenditures and Average Propensity to Consume (APC) by Gender and Year

	00-01	01-02	02-03	03-04	04-05	05-06	06-07
Female:							
Income before Taxes:	12,029	11,573	9,773	9,906	10,741	12,335	13,040
Consumer Expenditures:	15,313	15,589	15,059	14,841	15,421	17,097	19,014
APC:	1.27	1.35	1.54	1.50	1.44	1.39	1.46
Male:							
Income before Taxes:	12,168	12,557	13,014	13,285	13,680	15,043	16,328
Consumer Expenditures:	17,261	17,516	16,845	17,478	18,189	17,905	19,101
APC:	1.42	1.39	1.29	1.32	1.33	1.19	1.17

From "Consumer Expenditure Survey: Cross-tabulated Tables," by Bureau of Labor Statistics. 2009. Retrieved from http://www.bls.gov/cex/ csxcross.htm#y20001.

Return on investment (ROI), defined operationally for this study, is the net benefit generated from $1 of investment on Virginia's agricultural career and technical education program. Mathematically, ROI is calculated as:

$$ROI = \frac{Total\ Benefits - Total\ Costs}{Total\ Costs} = \frac{Net\ Benefits}{Costs}$$ (Phillips & Phillips, 2005, p. 2).

Total benefits included income tax and sales tax revenues. Income tax and sales tax revenues were generated from incomes resulting from the employment of the agricultural CTE completers and from the creation of additional jobs.

Population

The population used for this study consisted of 9,145 high school completers of Virginia's agricultural career and technical education programs from 2001 to 2007; Table 8 provides the total number of completers by year. The completers represented 97 Virginia school divisions that service 94 counties and cities and 21 planning districts. Students had completed one of seven agricultural programs: *Agricultural Business*, *Agricultural Machinery Service*, *Agricultural Production*, *Horticulture*, *Natural Resources Management*, *Turf Grass Management*, and *Veterinary Sciences*.

Table 8

Agricultural CTE Completers by Year

Program	00-01	01-02	02-03	03-04	04-05	05-06	06-07	Total
Total Completers	1,123	1,085	1,225	1,227	1,451	1,477	1,557	9,145

From "CTE Program Enrollment Report," by Office of Grants Reporting and Accounting, Virginia Department of Education. 2010. Retrieved from http://www.doe.virginia.gov/instruction/ career_technical/statistics_ reports/enrollment.shtml.

Methods of Data Collection

The agricultural CTE data collected on the 9,145 high school completers of Virginia's agricultural education programs were obtained from student responses to the post-graduation survey developed by "a committee assembled by the Office of Career and Technical Education Services that included teachers, administrators, and Virginia Department of Education personnel" (Pat O'Reilly, personal communication, April 8, 2010). All student responses were collected annually by "teachers, guidance counselors,

office staff, and/or hired retired personnel" within each respective school system and housed in the Center for Assessment, Evaluation, and Educational Programming at Virginia Polytechnic Institute and State University (Virginia Tech) (Pat O'Reilly, personal communication, January 15, 2010). The Center has participated in this project or variations thereof since approximately 1973, with the survey data used primarily for federal reporting. Instrument validity and reliability has been ensured "by the study of year-to-year consistency in survey responses and through cross-checks with other data sources, such as the Virginia Employment Commission and the National Student Clearinghouse" (Pat O'Reilly, personal communication, April 8, 2010).

The data consisted of descriptive information regarding incomes and student demographics (gender and race), student perceptions of the program, such as his/her preparedness for employment, and his/her current employment status. (See instrument in Appendix A.) In addition, state and federal funding (including Perkins' career and technical education monies and equipment monies allocated to the school divisions) per district was collected and housed at the Virginia Department of Education. Lastly, the rate of return on investment was determined using tax revenues and the real dollar value of additional output generated from the incomes of the agriculture career and technical education completers and expenditures from Virginia's Office of Career and Technical Education.

Statistical Analysis

Analyses of the agricultural CTE completer data obtained from Virginia Tech consisted of the use of SPSS and Excel in conducting descriptive statistics and in calculating the return on investment as determined through Kirkpatrick's four levels of

evaluation. Kirkpatrick's levels of evaluation included: *Level I – Student Reaction, Level II – Student Learning, Level III – Application of Knowledge and Skills*, and *Level IV – Results/Impact*. Determining the return on investment involved working through Research Questions 1 through 4. Each question resulted in values for those data elements necessary for the ROI calculation. Return on investment was initially estimated using costs and benefits for the completers and then by projecting benefits from the creation of additional labor expected to result from the expanding industry.

Research Question 1 required the researcher to produce SPSS cross-tabulations of completers and their survey responses to three survey questions, A, 2.1, and 2.2. Completers were to choose the best description for their education/career status in Question A (employed and in school, only employed, only in school, homemaker, homemaker and in school, military, or unemployed and not in school), identify their current employment status in Question 2.1 (FT, PT, FT and PT, or 2 or more PT jobs), and to indicate how related their employment was to their agricultural CTE program, Question 2.2 (closely related, somewhat related, or not related). All cross-tabulations included their graduation year and their gender. This enabled the researcher to analyze each annual cohort separately when calculating tax revenues and additional output and comparing to government funding of the programs.

Data for Research Question 2, federal and state funding of the agricultural CTE program, were collected from the Superintendent's memos housed at the Virginia Department of Education's website (VDOE-Superintendent, n.d.). These memos detail government funding, including federal Perkins' monies and equipment entitlements from the state.

Calculating income and sales tax revenues for Research Question 3 utilized income tax rates calculated from the Bureau of Labor Statistics (Table 6) and information collected from the Virginia Department of Taxation. The income tax rates were applied to incomes generated by the completers and the additional laborers that were created. Consumption expenditures of the completers and the additional laborers were calculated using the APC derived from the data obtained from the Bureau of Labor Statistics (Table 7) and the incomes generated for the completers and laborers using the appropriate real wage for each year. Once consumption expenditures were calculated, the sales tax rates of 4.5% for 2000-01 and 5% for 2002-07 were applied to those expenditures to determine sales tax revenues for each year. SPSS cross-tabulations of incomes and Virginia's planning districts were developed for investigating Research Question 4, variations in incomes among planning districts.

Addressing Research Question 5, return on investment for the state of Virginia, built upon Kirkpatrick's four levels of evaluations and utilized all calculations from Research Questions 1 through 4. The data sources for each level of evaluation are shown below.

Level I - Student Reaction

Student reaction was measured by student responses submitted to survey Question 1.1 – "Overall, how satisfied are you with the preparation you received at your school for employment and/or further education?"

SPSS cross-tabulations were run on student responses (very satisfied, satisfied, dissatisfied, or very dissatisfied) and their graduation year, gender, ethnicity, planning district, and employment status.

Level II – Student Learning

The population used in the study consisted of 9,145 students who had successfully completed agricultural CTE programs offered in secondary schools across the state. Because the students were completers, "student learning" was inferred to have been achieved. To have completed an agricultural program, "student learning" had to have taken place as measured by competency achievement as designated by the Virginia Department of Education for each agricultural education course.

Level III – Application of Knowledge and Skills

The completers' application of his/her knowledge and skills gained from the agricultural programs were derived from survey Questions 2.1 and 3.1.

2.1 – "Which best describes your current employment?"

3.1 – "Check all the types of education you have participated in since high school."

SPSS cross-tabulations were run on student responses to the two survey questions, 2.1 (FT, PT, FT and PT, or 2 or more PT jobs) and 3.1 (community college, technical school/college, registered apprenticeship, occupational/technical training through a local school system, business/industry training through the completer's employer, or other) and their description of their education and/or career status in Question A (employed and in school, only employed, only in school, homemaker, homemaker and in school, military, or unemployed and not in school); their graduation year; gender; ethnicity; planning district; employment status; and Question 2.2, how related the respondent's work is to his or her agricultural program. Completers who were employed and/or had participated in additional education and/or training had applied (or were applying) their knowledge

and/or skills, particularly those working in a job closely related to their agricultural program and/or those who had completed additional education and/or training.

Level IV – Results/Impact

The return on investment was derived from data collected for the total benefits and total costs of the agricultural CTE programs in the state of Virginia. The total benefits included monetary values for income; tax revenues; consumption; sales tax revenues; and the dollar value of additional output. Total costs were limited to the federal and state funding for the agricultural programs, including federal Perkins' monies and equipment monies allocated to the individual school divisions. The costs did not include costs for existing facilities or instructors. All dollar values were adjusted to 2009 real dollars. The steps below detail the process followed in calculating the ROI.

1. Determined the number of completers employed, including those who were employed in agriculture.
2. Determined the number of completers holding FT, PT, FT and PT, and 2 or more PT jobs. There were no responses to the survey question providing this information for the 2006 completers. According to O'Reilly at the CAEEP, 2006 responses to that survey question were not available (P. O'Reilly, personal communication, April 8, 2010). Linear regression was used with responses from 2001-2005 and 2007 to estimate the total number of 2006 students who were employed as full-time, part-time, full-time and part-time, or held two or more part-time jobs. Once the total was determined, ratios from the 2001-05 and 2007 were used to determine the counts for each employment classification in 2006.

3. Calculated incomes generated by the number of completers employed. Since the number of the employed completers in "1" exceeded the number classifying their employment type in "2", the ratios of employment type and gender in "2" were applied to the difference in those who indicated they were employed in "1" and those who had indicated an employment type in "2". Incomes were then generated on the basis of gender, employment type, real minimum wage, the number of weekly work hours, and the number of annual work weeks.
4. Income and sales tax revenues were then calculated using the income tax rates for a single person household and the 4.5% sales tax rate for 2000-01 and the 5% sales tax rate for 2002-07. Each was calculated in respect to gender and graduation year of the completer.
5. The creation of additional labor was estimated by using Rephann's (2008) assertion that one agricultural job creates 1.5 additional jobs. The number of agricultural jobs were determined by completer responses to survey Question 2.2, the extent to which the completer's work was related to his or her agricultural CTE program. Those who indicated their work was closely related or somewhat related were counted as completer's holding agricultural jobs.
6. The process then returns to step "2". The employment type (FT, PT, FT and PT, and 2 or more PT jobs) for the completer was used for the additional laborers. For example, if there were 10 females employed in full-time agricultural positions, there would be 15 additional females employed in full-

time positions. Once the additional workers were classified by employment type and gender, estimates of incomes, tax revenues, and additional output were calculated.

7. Lastly, additional incomes and tax revenues were estimated for those completers who had finished more training and/or education since high school. According to the U.S. Bureau of the Census (2004), an individual, age 18 to 29, with full-time employment status and some college (no degree) after high school earned 4.54% more in annual income. Aggregating full-time and part-time employment status, the individual, age 18 to 29, with some college (no degree) after high school increased his or her income by 0.49%. In order to avoid double counting a portion of incomes and tax revenues, the difference in the wages of those completers who had completed additional education and/or training and had indicated full-time employment status was increased by 4.54% and 0.49% for those indicating some college and part-time employment.
8. The return on investment by public schools in Virginia was calculated by estimating the total benefits and total costs for the 2000-07 period. Total benefits were equal to the sum of the estimated income and sales tax for the program completers and additional labor created by industry expansion. The total cost was the sum of state and federal entitlements allocated to the school divisions.

Summary

Chapter III delineated the methods and procedures used in addressing the problem and goals of the research study. This chapter provided the procedures used in addressing each of the five research questions, while incorporating Kirkpatrick's four levels of evaluation. An explanation of how the data were statistically processed was included at each step in the procedure, leading the researcher into the research findings in Chapter IV. The population of this study consisted of 9,145 agricultural career and technical education program completers who graduated from 2001 to 2007. In addition to descriptive statistical analyses, the researcher estimated income tax and sales tax revenues and collected governmental funding data in order to estimate the return on investment of the agricultural education program for the Commonwealth of Virginia. All monetary estimates were adjusted to 2009 dollars.

CHAPTER IV

FINDINGS

The purpose of this study was to determine the effect high school completion of the agricultural career and technical education program has on the rate of return on investment by public schools in Virginia. The following research questions were established to guide this study:

1. Were students able to find employment related to the agricultural career and technical education program they completed?
2. What federal and state funding was allocated for students participating in the agricultural career and technical education programs in the state of Virginia?
3. Was there a significant level of tax revenues generated by incomes from those who participated in the agricultural career and technical education program?
4. Did incomes from those who participated in the agricultural career and technical education program vary among statewide planning districts?
5. Did completion of the high school agricultural career and technical education program produce a return on investment for the Commonwealth of Virginia?

Research Questions 1, 4, and 5 were answered using existing agricultural career and technical education (CTE) completer data housed in the Center for Assessment, Evaluation, and Educational Programming (CAEEP) on the Campus of Virginia Tech. Federal and state (including federal Perkins' monies and equipment) monies allocated to the school divisions were used to address Research Question 2. Tax revenues for Research Question 3 were derived using income from the CTE completer data and after-tax and before-tax income found online at the Bureau of Labor Statistics. Lastly,

Research Question 5, the rate of return on investment, was determined using tax revenues generated from the incomes of the agricultural CTE completers, expenditures from Virginia's Office of Career and Technical Education, and the estimated real dollar value of output produced by the completers and the additional laborers.

Demographic Information

The existing agricultural career and technical education (CTE) completer data housed on the Campus of Virginia Tech were obtained from student responses to the post-graduation survey found in Appendix A. The data consisted of descriptive information for a population of 9,145 completers graduating from 2001 through 2007. The descriptive information included incomes and student demographics (gender and race); student perceptions of the program, such as his/her preparedness for employment; and his/her current employment status. Table 9 identifies the completers by gender and ethnicity for each of the aforementioned years. With the exception of 2001 to 2002, the number of completers increased each year from the previous year. The total number of completers grew by an average of 6.44% each year. The number of male completers increased by 31.10% (n = 852 to n = 1,117) from 2001 to 2007, with annual percentage rates from 71.74% to 77.05%. The number of females increased by 62.36% (n = 271 to n = 440), yielding annual percentage rates from 22.95% to 28.26% of the population. The population consisted of 90.26% (n = 8,254) White completers, 7.91% (n = 723) Black, 0.74% (n = 68) Hispanic or Latino, 0.38% (n = 44) Asian or Pacific Islander, 0.28% (n = 26) American Indian or Alaskan Native, and 0.33% (n = 30) unknown.

Table 9

Agricultural CTE Completers by Gender, Ethnicity, and Graduation Year

Variable		2001	2002	2003	2004	2005	2006	2007	Total
Gender									
Male	*n*	852	836	926	890	1,066	1,106	1,117	6,793
	%[a]	75.87	77.05	75.59	72.53	73.47	74.88	71.74	74.28
Female	*n*	271	249	299	337	385	371	440	2,352
	%[a]	24.13	22.95	24.41	27.47	26.53	25.12	28.26	25.72
Total		1,123	1,085	1,225	1,227	1,451	1,477	1,557	9,145
Ethnicity									
American Indian or Alaskan Native	*n*	6	1	1	13	1	3	1	26
	%[a]	0.53	0.09	0.08	1.06	0.07	0.20	0.06	0.28
Asian or Pacific Islander	*n*	13	4	6	4	1	10	6	44
	%[a]	1.16	0.37	0.49	0.33	0.07	0.68	0.39	0.48
Black	*n*	105	85	94	108	100	108	123	723
	%[a]	9.35	7.83	7.67	8.80	6.89	7.31	7.90	7.91
Hispanic or Latino	*n*	14	5	8	2	15	7	17	68
	%[a]	1.25	0.46	0.65	0.16	1.03	0.47	1.09	0.74
White	*n*	985	990	1,116	1,095	1,312	1,349	1,407	8,254
	%[a]	87.71	91.24	91.10	89.24	90.42	91.33	90.37	90.26
Unknown	*n*	0	0	0	5	22	0	3	30
	%[a]	0.00	0.00	0.00	0.41	1.52	0.00	0.19	0.33
Total		1,123	1,085	1,225	1,227	1,451	1,477	1,557	9,145

[a]Percentage of total completers for the given year. Table developed from Center for Assessment, Evaluation and Education Programming, Virginia (2002 & 2006). *Summary of follow-up information provided by Virginia's career and technical education program completers*: Virginia statewide report. Blacksburg, VA: Virginia Department of Education.

Table 10 provides the frequency of agricultural CTE completers by their program and year of graduation. The agricultural programs included: *agricultural business*, *agricultural machinery service*, *agricultural production*, *equine management*, *floral design*, *horticulture* (*regular* and *triple period*), *natural resources management*, *special programs*, *turf grass management*, and *veterinary science*. Approximately 85% (n = 7,762) of the students completed one of four programs during the seven-year period: *agricultural production* (n = 2,953 or 32.29%), *regular horticulture* (n = 1,872 or 20.47%), *agricultural machinery service* (n = 1,548 or 16.93%), and *agricultural business* (n = 1,389 or 15.19%). Three of the four programs exhibited positive growth in completers from 2001 to 2007. *Agricultural machinery service* grew 97.04% (n = 135 to n = 266); *regular horticulture*, 57.53% (n = 219 to n = 345); and *agricultural production*, 41.04% (n = 307 to n = 433). The number of completers in *agricultural business* actually fell from 291 to 206, a decline of 29.21%. *Equine management* was the least chosen agricultural program during the period (n = 12 or 0.13%).

Table 11 classifies the agricultural CTE completers according to Virginia's 21 planning districts, each district's identification number, and the graduation year of each completer. Table 12 provides the counties and/or cities included in each planning district. Figure 1 identifies the geographic location of each planning district. The following five districts accounted for more than half of the students who chose to pursue and complete an agricultural program during 2001 to 2007: Mount Rogers (n = 1,140 or 12.47%), Northern Shenandoah (n = 1,026 or 11.22%), Richmond Regional (n = 986 or

Table 10

Agricultural CTE Completers by Program and Graduation Year

Program		2001	2002	2003	2004	2005	2006	2007	Total
Agricultural Business	*n*	291	145	200	149	198	200	206	1,389
	%[a]	25.91	13.36	16.33	12.14	13.65	3.54	13.23	15.19
Agricultural Machinery Service	*n*	135	169	184	161	300	333	266	1,548
	%[a]	12.02	15.58	15.02	13.12	20.68	22.55	17.08	16.93
Agricultural Production	*n*	307	384	414	440	497	478	433	2,953
	%[a]	27.34	35.39	33.80	35.86	34.25	32.36	27.81	32.29
Equine Management	*n*	0	0	0	0	0	2	10	12
	%[a]	0.00	0.00	0.00	0.00	0.00	0.14	0.64	0.13
Floral Design	*n*	0	0	0	0	0	11	20	31
	%[a]	0.00	0.00	0.00	0.00	0.00	0.74	1.28	0.34
Horticulture (Regular)	*n*	219	209	268	299	262	270	345	1,872
	%[a]	19.50	19.26	21.88	24.37	18.06	18.28	22.16	20.47
Horticulture (Triple Period)	*n*	36	48	13	17	0	1	1	116
	%[a]	3.21	4.42	1.06	1.39	0.00	0.07	0.06	1.27
Natural Resources Management	*n*	100	110	111	107	152	111	108	799
	%[a]	8.90	10.14	9.06	8.72	10.48	7.52	6.94	8.74
Special Programs	*n*	35	20	35	54	24	16	25	209
	%[a]	3.12	1.84	2.86	4.40	1.65	1.08	1.61	2.29
Turf Grass Management	*n*	0	0	0	0	18	42	107	167
	%[a]	0.00	0.00	0.00	0.00	1.24	2.85	6.87	1.83
Veterinary Science	*n*	0	0	0	0	0	13	36	49
	%[a]	0.00	0.00	0.00	0.00	0.00	0.88	2.31	0.54
Total		1,123	1,085	1,225	1,227	1,451	1,477	1,557	9,145

[a]Percentage of total completers for the given year. Table developed from Center for Assessment, Evaluation and Education Programming, Virginia (2001-2007). *Summary of follow-up information provided by Virginia's career and technical education program completers*: Virginia statewide report. Blacksburg, VA: Virginia Dept. of Education.

Table 11

Agricultural CTE Completers by Planning District, Planning District Identification Number, and Graduation Year

Planning District	#		2001	2002	2003	2004	2005	2006	2007	Total
Lenowisco	1	*n*	20	8	19	18	23	26	17	131
		%[a]	1.78	0.74	1.55	1.47	1.59	1.76	1.09	1.43
Cumberland Plateau	2	*n*	28	29	41	38	34	40	18	228
		%[a]	2.49	2.67	3.35	3.10	2.34	2.71	1.16	2.49
Mount Rogers	3	*n*	119	137	163	185	159	196	181	1,140
		%[a]	10.60	12.63	13.31	15.08	10.96	13.27	11.62	12.47
New River Valley	4	*n*	41	57	52	74	86	76	99	485
		%[a]	3.65	5.25	4.24	6.03	5.93	5.15	6.36	5.30
Roanoke Valley-Alleghany Regional	5	*n*	27	32	32	20	46	39	37	233
		%[a]	2.40	2.95	2.61	1.63	3.17	2.64	2.38	2.55
Central Shenandoah	6	*n*	71	102	123	115	130	136	139	816
		%[a]	6.32	9.40	10.04	9.37	8.96	9.21	8.93	8.92
Northern Shenandoah Valley	7	*n*	116	114	144	124	180	162	186	1,026
		%[a]	10.33	10.51	11.76	10.11	12.41	10.97	11.95	11.22
Northern Virginia	8	*n*	35	19	17	7	15	14	23	130
		%[a]	3.12	1.75	1.39	0.57	1.03	0.95	1.48	1.42
Rappahannock-Rapiden	9	*n*	73	57	57	57	101	96	120	561
		%[a]	6.50	5.25	4.65	4.65	6.96	6.50	7.71	6.13
Thomas Jefferson	10	*n*	34	20	38	40	42	28	41	243
		%[a]	3.03	1.84	3.10	3.26	2.89	1.90	2.63	2.66
Region 2000	11	*n*	77	55	56	76	64	93	84	505
		%[a]	6.86	5.07	4.57	6.19	4.41	6.30	5.39	5.52
West Piedmont	12	*n*	93	96	131	105	141	147	129	842
		%[a]	8.28	8.85	10.69	8.56	9.72	9.95	8.29	9.21
Southside	13	*n*	37	46	51	37	30	27	39	267
		%[a]	3.29	4.24	4.16	3.02	2.07	1.83	2.50	2.92
Commonwealth Regional	14	*n*	78	79	74	86	98	88	117	620
		%[a]	6.95	7.28	6.04	7.01	6.75	5.96	7.51	6.78
Richmond Regional	15	*n*	137	100	130	120	168	161	170	996
		%[a]	12.20	9.22	10.61	9.78	11.58	10.90	10.92	10.89

Table 11 (continued)

Planning District	#		2001	2002	2003	2004	2005	2006	2007	Total
George Washington Regional	16	*n*	21	39	17	24	47	30	45	223
		%[a]	1.87	3.59	1.39	1.96	3.24	2.03	2.89	2.44
Northern Neck	17	*n*	16	22	13	12	8	9	12	92
		%[a]	1.42	2.03	1.06	0.98	0.55	0.61	0.77	1.01
Middle Peninsula	18	*n*	20	13	27	23	21	31	22	157
		%[a]	1.78	1.20	2.20	1.87	1.45	2.10	1.41	1.72
Crater	19	*n*	22	24	12	11	18	20	13	120
		%[a]	1.96	2.21	0.98	0.90	1.24	1.35	0.83	1.31
Accomack-Northampton	22	*n*	2	2	8	8	7	6	13	46
		%[a]	0.18	0.18	0.65	0.65	0.48	0.41	0.83	0.50
Hampton Roads	23	*n*	53	34	20	47	33	52	52	291
		%[a]	4.72	3.13	1.63	3.83	2.27	3.52	3.34	3.18
Unknown		*n*	3	0	0	0	0	0	0	3
		%[a]	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.03
Total			1,123	1,085	1,225	1,227	1,451	1,477	1,557	9,145

[a]Percentage of total completers for the given year. Table developed from Center for Assessment, Evaluation and Education Programming, Virginia (2002 & 2006). *Summary of follow-up information provided by Virginia's career and technical education program completers*: Virginia statewide report. Blacksburg, VA: Virginia Department of Education.

10.78%), West Piedmont (n = 842 or 9.21%), and Central Shenandoah (n = 816 or 8.92%). Although the Accomack-Northampton district reported the fewest number of completers (n = 46 or 0.50%), the district bore the largest percentage growth in completers for the seven-year period, 550.00% (n = 2 to n = 13). Other districts revealing growth in excess of 100% were New River, 141.46% (n = 41 to n = 99) and George

Washington, 114.29% (n = 21 to n = 223). Crater experienced the largest reduction in completers, 40.91% (n = 22 to n = 13).

Table 12

Virginia's Counties and Cities by Planning Districts

#	Planning District	Counties	Cities
1	Lenowisco	Lee, Scott, Wise	Norton
2	Cumberland Plateau	Buchanan, Dickenson, Russell, Tazewell	
3	Mount Rogers	Bland, Carroll, Grayson, Smyth, Washington, Wythe	Bristol, Galax
4	New River Valley	Floyd, Giles, Montgomery, Pulaski	Radford
5	Roanoke Valley-Alleghany	Alleghany, Botetourt, Craig, Franklin, Roanoke	Covington, Roanoke, Salem
6	Central Shenandoah	Augusta, Bath, Highland, Rockbridge	Buena Vista, Harrisonburg, Lexington, Staunton, Waynesboro
7	Northern Shenandoah Valley	Clarke, Frederick, Page, Shenandoah, Warren	Winchester
8	Northern Virginia	Arlington, Fairfax, Loudon, Prince William	Alexandria, Fairfax, Falls Church, Manassas, Manassas Park
9	Rappahannock-Rapidan	Culpeper, Fauquier, Madison, Orange, Rappahannock	
10	Thomas Jefferson	Albemarle, Fluvanna, Greene, Louisa, Nelson	Charlottesville
11	Virginia's Region 2000	Amherst, Appomattox, Bedford, Campbell	Bedford, Lynchburg
12	West Piedmont	Franklin, Henry, Patrick, Pittsylvania	Danville, Martinsville

Table 12 (continued)

#	Planning District	Counties	Cities
13	Southside	Brunswick, Halifax, Mecklenburg	
14	Commonwealth	Amelia, Buckingham, Charlotte, Cumberland, Lunenburg, Nottoway, Prince Edward	
15	Richmond Regional	Charles City, Chesterfield, Goochland, Hanover, New Kent, Powhatan	Richmond
16	George Washington	Caroline, King George, Spotsylvania, Stafford	Fredericksburg
17	Northern Neck	Lancaster, Northumberland, Richmond, Westmoreland	
18	Middle Peninsula	Essex, Gloucester, King and Queen, King William, Mathews, Middlesex	
19	Crater	Chesterfield, Dinwiddie, Greensville, Prince George, Surry, Sussex	Colonial Heights, Emporia, Hopewell, Petersburg
22	Accomack-Northampton	Accomack, Northampton	
23	Hampton Roads	Gloucester, Isle of Wright, James City, Southampton, York	Chesapeake, Franklin, Hampton City, Newport News, Norfolk, Poquoson, Portsmouth, Suffolk, Virginia Beach, Williamsburg

From "PDC Member Localities," by Virginia Chapter of the American Planning Association. n.d. Retrieved from http://www.vapdc.org/aboutpdcs.htm#PDC Map.

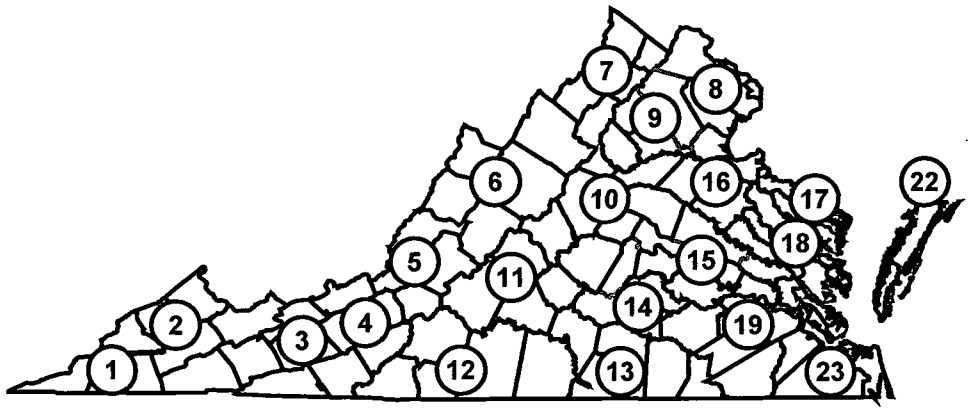

Figure 1. Virginia's planning districts identified by geographic location. Developed using SmartDraw and "PDC Member Localities," by Virginia Chapter of the American Planning Association. n.d. Retrieved from http://www.vapdc.org/aboutpdcs.htm#PDC Map.

How has the number of agricultural CTE completers compared to total student enrollment and the total number of completers of all CTE programs in the state? While the number of students enrolled in one or more CTE course(s) increased only 5.68% from 2001 to 2007, the number of students completing a CTE program increased 14.99%, suggesting greater success in the recruitment of students into CTE programs by their positive experiences in an initial course or courses (Table 13). As illustrated in Figure 2, the numbers of agricultural CTE completers as a percentage of total enrollment for grades 7 through 12 (Appendix B) were relatively flat from 2001 to 2007, increasing 0.05 percentage points from 2001 to 2007. However, the percentage of students choosing to pursue and complete an agricultural program over all other CTE programs increased 0.83 percentage points, as evidenced by the upward sloping trend line in Figure 2.

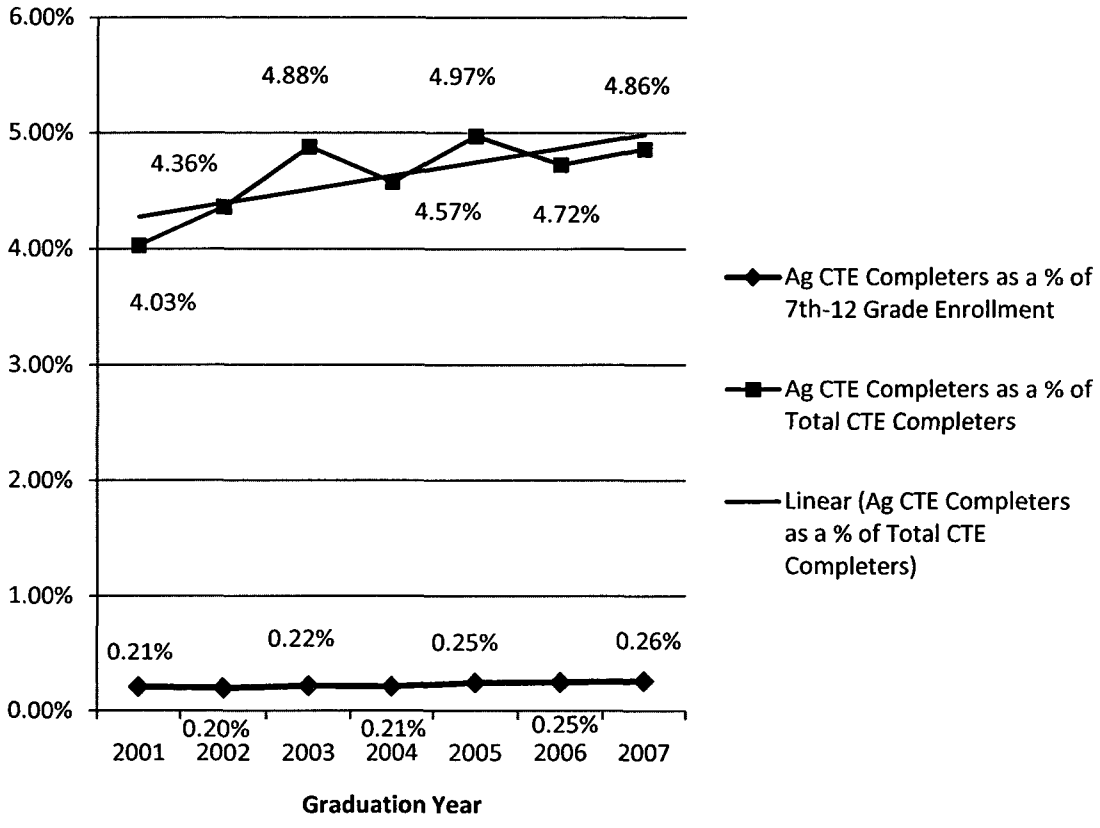

Figure 2. Agricultural CTE completers as a percentage of 7th-12th grade enrollment and as a percentage of CTE completers of all programs. Data obtained from "CTE Program Enrollment Report," by Office of Grants Reporting and Accounting, Virginia Department of Education. 2010. Retrieved from http://www.doe.virginia.gov/instruction/career_technical/statistics_ reports/enrollment.shtml.

Table 13

Middle School and High School CTE Course Enrollment and Completers

	2001	2002	2003	2004	2005	2006	2007
CTE Enrollment[a]	559,172	557,940	574,686	585,115	597,254	582,314	590,921
CTE Completers	27,868	24,885	25,112	26,828	29,186	31,275	32,045

[a]Enrolled in one or more CTE course(s). From "CTE Program Enrollment Report," by Office of Grants Reporting and Accounting, Virginia Department of Education. 2010. Retrieved from http://www.doe.virginia.gov/instruction/ career_technical/statistics_ reports/enrollment.shtml.

Research Question Findings

The agricultural career and technical education (CTE) completer survey (Appendix A) consisted of five sections: current education and career status; satisfaction in secondary school preparation for employment; current employment, including income and benefits; continuing education and training; and explanation of unemployment. Research Questions 1-4 required the collection of and analysis of completer data needed in addressing Question 5, the return on investment of high school completion of agricultural career and technical education program for Virginia.

Research Question 1

Were students able to find employment related to the agricultural career and technical education program they completed? The frequency function in the Statistical Package for the Social Sciences (SPSS) and Microsoft Excel was used to analyze completer responses to four survey questions: Question A, "Which best describes you;"

Question 2.1, "Which best describes your current employment;" Question 2.2, "To what extent is your work related to the program you completed at school;" and Question 2.3, "How much of what you learned in your courses are you using for your job?" Approximately 83.27% or 7,615 responded to Question A, 41.14% or 3,762 to Question B, 40.00% or 3,655 provided a response to Question 2.2, and 39.04% or 3,570 to Question 2.3. Table 14 displays completer responses to those survey questions. Only 5.63% (n = 429) of those responding to Question A indicated they were unemployed and not enrolled in school. Approximately 66.30% (n = 5,049) were employed or serving in the military, 52.53% (n = 4,000) were enrolled in school, and 1.13% (n = 86) were homemakers. Of those employed, 74.51% further indicated their employment classification. Of those indicating employment classification, 56.57% (n = 2,128) had full-time employment; 39.31% (n = 1,479), part-time; 1.46% (n = 55), full-time and part-time; and 2.66% (n = 100), two or more part-time jobs. Of the 9,145 agricultural CTE completers who responded to Question 2.2 (relationship between work and program completed at school), approximately 26.65% (n = 974) indicated their work was closely related to their agricultural CTE program; 40.79% (n = 1,491) stated their work was somewhat related; and 32.56% (n = 1,190) believed their work was not related. Of those responding Question 2.3 (application of course content to job requirements), 66.68% (n = 2,410) indicated they were using most or some of what they had learned in their agricultural program in their employment. Only 15.22% (n = 550) were in jobs where their knowledge of their previous course content was not being used.

Table 14

The Relationship between Employment and Agricultural CTE Program and Coursework

Response	Frequency	Percent of those Responding
Question A (Employment Description):		
Employed and in School	1,942	25.50%
ONLY Employed	2,797	36.73%
ONLY in School	2,051	26.93%
Homemaker	79	1.04%
Homemaker and in School	7	0.09%
Military	310	4.07%
Unemployed and not in School	429	5.63%
Total Responding	7,615	100.00%
Question 2.1 (Employment Classification):		
Full-time (≥ 30 hours per week)	2,128	56.57%
Part-time (< 30 hours per week)	1,479	39.31%
Full-time and Part-time	55	1.46%
≥ 2 Part-time	100	2.66%
Total Responding	3,762	100.00%
Question 2.2 (Relationship between Work and School Program):		
Closely Related	974	26.65%
Somewhat Related	1,491	40.79%
Not Related	1,190	32.56%
Total Responding	3,655	100.00%
Question 2.3 (Application of Course Content to Work):		
Most	857	23.71%
Some	1,553	42.97%
Little	654	18.10%
None	550	15.22%
Total Responding	3,614	100.00%

From "CTE Program Enrollment Report," by Office of Grants Reporting and Accounting, Virginia Department of Education. 2010. Retrieved from http://www.doe.virginia.gov/instruction/ career_technical/statistics_ reports/enrollment.shtml.

Research Question 2

What federal and state funding was allocated for students participating in agricultural career and technical education programs in the state of Virginia? Government funding for career and technical education for 2001-2007 totaled $216,461,279. Federal allocations accounted for 68.98% ($149,316,213) of the total, with the state contributing 31.02% ($67,145,065), 3.08% ($6,663,000) of which was allocated specifically for equipment. Table 14 details the allocations in nominal terms, value in the year of distribution, and in real terms. To estimate the total cost of the agricultural CTE programs in Virginia, the total allocations for all CTE programs from Table 15 were divided by the total number of CTE completers for the seven-year period, yielding cost per CTE completer and that cost was then multiplied by the total number of agricultural CTE completers, that is,

$$\frac{Total\ Cost\ for\ All\ CTE\ Programs}{Total\ CTE\ Completers} \times Total\ Ag\ Completers$$

$$\frac{216{,}183{,}025}{197{,}199} \times 9{,}145 = 10{,}025{,}374.$$

Research Question 3

Was there a significant level of tax revenues generated by incomes from those who participated in the agricultural career and technical education program? Tax revenues were generated from two groups of individuals in this study, the agricultural

Table 15

Federal and State Allocations for Career and Technical Programs in Virginia

Sources	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	Total
Nominal Values:								
Perkins	17,843,782	18,294,075	19,611,760	19,411,572	19,137,046	19,457,046	18,645,745	132,401,026
State	7,696,020	7,572,631	7,573,866	7,668,793	7,668,354	7,668,353	7,758,213	53,606,230
Equipment	700,000	700,000	700,000	700,000	700,000	700,000	1,800,000	6,000,000
Total	26,239,802	26,566,706	27,885,626	27,780,365	27,505,400	27,825,399	28,203,958	192,007,256
2009 Values:								
Inflation[a]:	0.21	0.19	0.17	0.14	0.10	0.05	0.03	
Perkins	21,590,976	21,769,949	22,945,759	22,129,192	21,050,751	20,624,469	19,205,117	149,316,213
State	9,312,184	9,011,431	8,861,423	8,742,424	8,435,189	8,128,454	7,990,959	60,482,065
Equipment	847,000	833,000	819,000	798,000	770,000	742,000	1,854,000	6,663,000
Total	31,750,160	31,614,380	32,626,182	31,669,616	30,255,940	29,216,669	29,050,077	216,183,025

[a]Inflation was derived from the average consumer price index for that particular year. From "Databases, Tables, and Calculators by Subject," by U.S. Bureau of Labor Statistics. n.d. Retrieved from http://www.bls.gov/data/inflation_ calculator.htm and from "Superintendent's Memos," by Virginia Department of Education, n.d. Retrieved from http://www.doe.virginia.gov/administrators/superintendents_memos/2000/index.shtml.

CTE completers and the additional laborers created by the expansion of the agricultural industry. Estimates of those revenues included income and sales tax rates applied to the income and consumption estimates of the completers and the additional laborers, the estimates of the additional income resulting from training and/or education acquired after the completers graduated from high school, and the output from the completers and the additional laborers. Appendices C through J provide detailed estimates of income, consumption, and tax revenues and the average propensity to consume (APC) and income and sales tax rates used to calculate the consumption and tax revenues. Values were provided for both completers and additional laborers by gender and graduation year (2001-07). Table 16, an abbreviated version of Appendices C through J, displays estimated totals of income, consumer expenditures, and tax revenues for the seven-year period.

Revenue estimates for the agricultural CTE completers (n = 5,049) and the additional laborers (n = 4,379) produced $124,017,008 in real income, $4,320,486 in income tax revenues, and $8,076,583 in sales tax revenues. Of the total income, $418,604 or 0.34% resulted from the increase in wages for 1,408 of the completers who had acquired additional education and/or training since graduating from high school. The increase in wages contributed $15,740 (0.36%) to total income tax revenues and $31,541 (0.39%) to total sales tax revenues. The multiple of 1.5 used in projecting additional jobs/laborers was not in reference to a specific gender-type.

Table 16

Total Income and Tax Revenues by Gender

	Female		Male		
	Total	% of Total	Total	% of Total	Total
Completers (n = 5,049; 1,169 or 23.15% female and 3,880 or 76.85% male):					
Income:	12,504,886	19.05%	53,132,367	80.95%	65,637,254
Income Tax Revenues:	374,552	16.48%	1,897,809	83.52%	2,272,361
Consumer Expenditures:	17,835,287	20.54%	68,977,001	79.46%	86,812,288
Sales Tax Revenues:	883,467	20.61%	3,403,001	79.39%	4,286,468
Additional Laborers (n = 4,379; 701 or 16.01% female and 3,678 or 83.99% male):					
Income:	7,444,916	12.84%	50,516,235	87.16%	57,961,151
Income Tax Revenues:	224,731	11.06%	1,807,654	88.94%	2,032,384
Consumer Expenditures:	10,571,371	13.88%	65,565,279	86.12%	76,136,650
Sales Tax Revenues:	522,758	13.91%	3,235,816	86.09%	3,758,574
Additional Education/Training (n = 1,408; 418 or 29.69% female; 990 or 70.31% male):					
Income:	88,059	21.04%	330,545	78.96%	418,604
Income Tax Revenues:	2,697	17.14%	13,043	82.86%	15,740
Consumer Expenditures:	144,398	22.47%	498,222	77.53%	642,619
Sales Tax Revenues:	7,141	22.64%	24,400	77.36%	31,541
Total:					
Income:	20,037,861	16.16%	103,979,147	83.84%	124,017,008
Income Tax Revenues:	601,980	13.93%	3,718,506	86.07%	4,320,486
Consumer Expenditures:	28,551,056	17.45%	135,040,502	82.55%	163,591,558
Sales Tax Revenues:	1,413,366	17.50%	6,663,217	82.50%	8,076,583

From "Consumer Expenditure Survey: Cross-tabulated Tables," by Bureau of Labor Statistics. 2009. Retrieved from http://www.bls.gov/cex/ csxcross.htm#y20001.

Research Question 4

Did incomes from those who participated in the agricultural career and technical education programs vary among statewide planning districts? The large range in the number of wage-earners (minimum = 11; maximum = 469) and in the number of completers (minimum = 46; maximum = 1,140) relative to the small number of planning districts (n = 21) revealed considerable variation in the observed frequencies of both distributions. The standard deviations for the number of wage-earners and the number of completers were 121.43 and 344.58, respectively. The descriptive statistics in Table 17 suggests that both distributions were positively skewed since the mode (97) for the number of wage-earners was less than the median (101) which was less than the mean (156.90) and since the median (267) for the number of completers was less than the mean (435.81). No frequency for the number of completers appeared more than once, thus, negating a value for the mode.

Table 17

Descriptive Statistics of Wage-earners and Completers

	Wage-earners	Completers
Minimum	11	46
Maximum	469	1,140
Mean	156.90	435.81
Median	101	267
Mode	97	n/a
Standard Deviation	121.43	344.58

Analyzing the actual numbers of both groups, displayed in Table 18, revealed a very strong positive correlation between the number of completers and the number of wage-earners. SPSS generated a Pearson correlation coefficient (r) of 0.966 ($\alpha = 0.01$), illustrating that as one variable increases, the other variable does as well. A Pearson coefficient of 0.966 indicates that $r^2 = 0.93$ or 93% of the variability in either variable (completers or wage-earners) could be explained by its relationship with the other variable.

In addition, the last column in Table 18, wage-earners as a percentage of completers, provides a measure of success for each district, that is, how successful completers are in gaining employment within one year of graduating from high school. Middle Peninsula had the greatest percentage (50.00%; 46:92) of completers finding employment in the given timeframe. Accomack-Northampton produced the lowest percentage (23.91%; 11:46).

Research Question 5

Did completion of the high school agricultural career and technical education program produce a return on investment for the Commonwealth of Virginia? To determine the return on investment, the researcher, following Kirkpatrick's four levels of evaluation, used completer data from the post-graduation survey in Appendix A, federal and state funding of the agricultural CTE program from Superintendent's memos housed at the Virginia Department of Education's website (VDOE-Superintendent, n.d.), and personal tax rates and consumption from the Bureau of Labor Statistics (Bureau of Labor Statistics, 2009).

Table 18

Completers and Wages Earned by Planning District

	Hourly Wage											
	< $6		$6 to $8.99		$9 to 12		> $12					Wage-earners as
Planning District	n	% of Total	n	% of Total	n	% of Total	n	% of Total	Total	% of Total	# of Completers	a % of Completers
1-Lenowisco	8	3.35%	19	1.06%	9	0.85%	3	1.39%	39	1.18%	131	29.77%
2-Cumberland Plateau	26	10.88%	59	3.30%	15	1.42%	5	2.31%	105	3.19%	228	46.05%
3-Mount Rogers	46	19.25%	280	15.68%	122	11.56%	21	9.72%	469	14.23%	1,140	41.14%
4-New River	18	7.53%	121	6.77%	50	4.74%	11	5.09%	200	6.07%	485	41.24%
5-Roanoke Valley-Alleghany Regional	5	2.09%	66	3.70%	21	1.99%	5	2.31%	97	2.94%	233	41.63%
6-Central Shenandoah	15	6.28%	177	9.91%	112	10.62%	18	8.33%	322	9.77%	816	39.46%
7-Northern Shenandoah Valley	13	5.44%	157	8.79%	125	11.85%	27	12.50%	322	9.77%	1,026	31.38%
8-Northern Virginia	1	0.42%	26	1.46%	10	0.95%	10	4.63%	47	1.43%	130	36.15%

Table 18 (continued)

	Hourly Wage											
	< $6		$6 to $8.99		$9 to 12		> $12					Wage-earners as
Planning District	n	% of Total	n	% of Total	n	% of Total	n	% of Total	Total	% of Total	# of Completers	a % of Completers
9-Rappahannock-Rapidan	1	0.42%	71	3.98%	84	7.96%	20	9.26%	176	5.34%	561	31.37%
10-Thomas Jefferson	4	1.67%	43	2.41%	35	3.32%	15	6.94%	97	2.94%	243	39.92%
11-Region 2000	19	7.95%	101	5.66%	51	4.83%	8	3.70%	179	5.43%	505	35.45%
12-West Piedmont	36	15.06%	183	10.25%	72	6.82%	18	8.33%	309	9.38%	842	36.70%
13-Southside	6	2.51%	56	3.14%	25	2.37%	5	2.31%	92	2.79%	267	34.46%
14-Commonwealth Regional	14	5.86%	130	7.28%	68	6.45%	6	2.78%	218	6.61%	620	35.16%
15-Richmond Regional	6	2.51%	114	6.38%	123	11.66%	13	6.02%	256	7.77%	996	25.70%
16-George Washington Regional	3	1.26%	39	2.18%	39	3.70%	9	4.17%	90	2.73%	223	40.36%

Table 18 (continued)

	Hourly Wage											
	< $6		$6 to $8.99		$9 to 12		≥ $12					Wage-earners as
Planning District	n	% of Total	n	% of Total	n	% of Total	n	% of Total	Total	% of Total	# of Completers	a % of Completers
17-Northern Neck	3	1.26%	27	1.51%	14	1.33%	2	0.93%	46	1.40%	92	50.00%
18-Middle Peninsula	3	1.26%	13	0.73%	19	1.80%	6	2.78%	41	1.24%	157	26.11%
19-Crater	1	0.42%	29	1.62%	16	1.52%	5	2.31%	51	1.55%	120	42.50%
22-Accomack-Northampton	2	0.84%	7	0.39%	2	0.19%	0	0.00%	11	0.33%	46	23.91%
23-Hampton Roads	9	3.77%	67	3.75%	43	4.08%	9	4.17%	128	3.88%	291	43.99%
Unknown	0	0.00%	1	0.06%	0	0.00%	0	0.00%	1	0.03%		
Total	239		1,786		1,055		216		3296			

Level I – Student Reaction

Student reaction was measured by student responses submitted to survey Question 1.1, "Overall, how satisfied are you with the preparation you received at your school for employment and/or further education?" Of those responding to Question 1.1 (n = 7,012 or 76.68%), 98.15% indicated they were satisfied or very satisfied in how well their respective high schools had prepared them for employment and/or additional education. When analyzing responses to Question 1.1 according to those who indicated they were employed in Question A, the researcher found that 90.28% (n = 4,558 – 1,811 employed and in school, 252 in the military, and 2,495 only employed) were satisfied or very satisfied in the preparation they had received. In regards to additional education, approximately 93.01% (n = 3,714 – 1,811 employed and in school and 1,903 only in school) of those in school reported their preparation to be satisfactorily or very satisfactorily. Completer responses are shown in Table 19.

Table 19

Completer Indication of Satisfaction in Employment Preparation by High School

	00-01	01-02	02-03	03-04	04--05	05-06	06-07	Total
Very Satisfied	239	256	356	307	387	355	380	2,280
Satisfied	516	502	586	657	731	776	834	4,602
Sub-total	755	758	942	964	1,118	1,131	1,214	6,882
Dissatisfied	16	18	12	23	18	13	15	115
Very Dissatisfied	5	0	0	1	3	2	4	15
Sub-total	21	18	12	24	21	15	19	130

Level II – Student Learning

The population used in the study consisted of 9,145 students who had successfully completed agricultural CTE programs offered in secondary institutions across Virginia. Because the students had successfully completed one of the agricultural programs, "student learning" was inferred to have been achieved. To have completed an agricultural program, "student learning" had to have taken place as judged by achievement of course competencies by the Virginia Department of Education. Completers of an agricultural program had completed two or more agricultural CTE courses.

Level III – Application of Knowledge and Skills

The completers' application of his/her knowledge and skills gained from the agricultural programs were derived from survey Questions A, 2.1, and 3.1, "Which best describes you," "Which best describes your current employment," and "Check all the types of education you have participated in since high school." The application of completer knowledge and skills acquired during their enrollment in the agricultural CTE program was inferred by their indication of employment and/or completion of additional training and/or education since their high school graduation. According to the survey responses, 5,049 (66.30%) of those responding to Question A were employed, with 2,128 indicating full-time employment, 1,479 part-time employment, 55 holding full-time and part-time jobs, and 100 employed in two or more part-time jobs (Question 2.1). Of the 5,049 employed, 65.16% (n = 3,290) had acquired additional training and/or education since graduating from high school, with some receiving training and/or education from multiple sources. Table 20 reveals the number of completers by source of additional

education or training. More than half of those completers received their additional education or training from the community college. Of the 3,290 completers who had acquired additional training and/or education, only 1,408 indicated their full-time and/or part-time employment status and their current wage interval. Of those 3,290 completers, 144 had acquired additional education and/or training two or more sources identified in Table 20.

Table 20

Agricultural CTE Completers Acquiring Additional Education and/or Training

Education/Training[a]	Completers	%
Community College	1,785	54.26%
Four-Year University	942	28.63%
Technical School/College	203	6.17%
Registered Apprenticeship	36	1.09%
Occupational /Technical Training-Local School System	38	1.16%
Business/Industry Training-Employer	215	6.53%
Other	215	6.53%
Total	3,290	

[a]Completers may have fulfilled education and/or training requirements through more than one entity in the table.

Level IV – Results/Impact

The return on investment (ROI) by public schools in Virginia was calculated initially by estimating the total benefits and total costs (shown in Tables 21 and 22) for the 2001-07 completers and then by including the additional benefits generated from the projected increase in laborers. Total benefits were equal to the sum of the estimated income and sales tax revenues. The total cost was the sum of state and federal

entitlements allocated to the school divisions. Substituting the total benefits and costs for the completers and those having additional education and/or training gave a ROI of -$0.34; that is, for every $1 invested by the Commonwealth of Virginia, a net return of -$0.34 resulted. The total of net benefits was -$3,419,264. See Table 21.

$$ROI = \frac{Total\ Benefits - Total\ Costs}{Total\ Costs} = \frac{6{,}606{,}110 - 10{,}025{,}374}{10{,}025{,}374} = -\$0.34$$

Table 21

Total Benefits and Costs of the Agricultural CTE Completers

Total Benefits:		6,606,110
Income Tax Revenues:	2,288,101	
Sales Tax Revenues:	4,318,009	
Total Costs:		10,025,374
State & Federal Allocations:	10,025,374	
Return on Investment:		-$0.34

From "Consumer Expenditure Survey: Cross-tabulated Tables," by Bureau of Labor Statistics. 2009. Retrieved from http://www.bls.gov/cex/csxcross. htm#y20001.

However, when income and tax revenues from the additional laborers was included, $0.24 was returned in the form of revenues for every $1 invested by the Commonwealth. The total of net benefits was $2,371,695. See Table 22.

$$ROI = \frac{Total\ Benefits - Total\ Costs}{Total\ Costs} = \frac{12{,}397{,}069 - 10{,}025{,}374}{10{,}025{,}374} = \$0.24$$

Table 22

Total Benefits and Costs of the Agricultural CTE Completers and Additional Laborers

Total Benefits:		12,397,069
Income Tax Revenues:	4,320,486	
Sales Tax Revenues:	8,076,583	
Total Costs:		10,025,374
State & Federal Allocations:	10,025,374	
Return on Investment:		$0.24

From "Consumer Expenditure Survey: Cross-tabulated Tables," by Bureau of Labor Statistics. 2009. Retrieved from http://www.bls.gov/cex/csxcross. htm#y20001.

Summary

The purpose of this study was to determine the effect high school completion of the agricultural career and technical education program has on the rate of return on investment by public schools in Virginia. To address this issue, responses to a post-graduation survey (Appendix A) by completers served as the foundation from which the investigation began. A detailed account of the findings of the study was provided in this chapter.

Statistical analyses of the survey responses provided descriptive information on 9,145 completers of the agricultural CTE program who graduated from 2001 to 2007. Of those completers, 25.70% were female, 74.30% male. Approximately 9% indicated minority ethnicity. Employment information varied among respondents. According to Question A, 5,049 indicated they were employed; yet, only 3,762 revealed their

employment classification (employed full-time, part-time, full-time and part-time, or in two or more part-time positions). Likewise, only 3,346 responded to Question 2.6, "How much does your job pay before taxes?"

In working through the five research questions and Kirkpatrick's four levels of evaluation, the researcher discovered that completers of the agricultural CTE program generated, directly and indirectly, enough income tax and sales tax revenues to yield a positive return on investment. The total benefits and total costs of the program for completers were $6,606,110 and $10,025,374, respectively, generating a ROI of -$0.34. That is, a dollar invested into the program would yield a decrease of 34%. Including income and sales tax revenues from the projected increase in labor resulted in total benefits and total costs of $12,397,069 and $10,025,374, respectively, generating a ROI of $0.24. A dollar invested into the program would yield an increase of 24%.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

This chapter provides the summary, conclusions, and future recommendations from the researcher's investigation of the effect high school completion of the agricultural career and technical education program has on the rate of return on investment by public schools in Virginia. The investigation utilized three primary sources of data: survey responses from high school completers of the agricultural career and technical education program; federal and state funding (including Perkins' monies and equipment monies allocated to each school division) from the Virginia Department of Education; and income and sales tax rates, price indices, and household consumption expenditures from the Bureau of Labor Statistics. Survey responses from the agricultural CTE completers were housed at the Center for Assessment, Evaluation, and Educational Programming (CAEEP) on the Campus of Virginia Polytechnic Institute and State University. Permission for use was granted by the Director of Career and Technical Education, Virginia Department of Education. The survey data included responses from 9,145 completers who graduated from Virginia's secondary institutions from 2001 to 2007. In order to calculate the return on investment, the primary goal of this research study, federal and state funding and tax, consumption, and price data were collected for the same seven-year period.

Summary

The purpose of this study was to determine the effect high school completion of the agricultural career and technical education program has on the rate of return on

investment by public schools in Virginia. The research questions guiding the study included:

1. Were students able to find employment related to the agricultural career and technical education program they completed?
2. What federal and state funding was allocated for students participating in the agricultural career and technical education programs in the state of Virginia?
3. Was tax revenue generated by incomes from those who participated in the agricultural career and technical education program?
4. Did incomes from those who participated in the agricultural career and technical education program vary among statewide planning districts?
5. Did completion of the high school agricultural career and technical education program produce a return on investment for the Commonwealth of Virginia?

SPSS and Microsoft Excel were used to analyze the completer survey data from CAEEP in order to address Research Questions 1, 4, and 5. Federal and state (including Perkins' monies and equipment monies allocated to the school divisions) for Research Question 2 was collected from the Virginia Department of Education. Tax revenues for Research Question 3 were derived using income from the CTE completer data and after-tax and before-tax income at the Bureau of Labor Statistics. The ROI, Research Question 5, was calculated using tax revenues generated from the incomes of the agricultural CTE completers and expenditures from Virginia's Office of Career and Technical Education and the estimated real dollar value of output produced by the completers and the additional laborers. The completion of such research would make a significant contribution to existing ROI research. There has been considerable research completed

on agriculture and the return on investment in the United States, as well as in the state of Virginia. Until the 1990s, research on the ROI focused primarily upon training in the business sector. In the last two decades, research has increased on the usefulness of the ROI model in the public sector (Anderson & Woodill, 2004; Boyle & Crosby, 1997; Brauchle & Schmidt, 2004; Brewer, 2007; Bryson, 1993; Cardenas, 2007; Glover, Long, Haas, & Alemany, 1999; Hood, 2007; Munoz & Munoz, 2000; Russ-Eft & Preskill, 2005). However, there has been no research investigating the return on investment for Virginia's high school agricultural career and technical education programs. The results of this study would be significant or valuable to the state in its overall strategic planning process and would show how other career and technical education programs could contribute financially to the economy.

As with any research study, there were limitations to the study as well as assumptions made. The researcher recognized six limitations to the study and made four assumptions. The limitations were as follows: generalizations of the findings were limited to each school division and planning district within Virginia; in determining the rate of return on educational investment in Virginia, the study did not account for differences in race, gender, age, or learning disabilities; the rate of return on educational investment was based on the agricultural career and technical education program completer's employment one year after graduation; tax revenue and federal and state funding were limited to governmental policies and/or legislation in place for each respective year; the rate of return on educational investment did not reflect the total costs of the program (included federal and state allocations / excluded teachers' and staff salaries and fringe benefits, costs for infrastructure, such as buildings and facilities and

the operational costs of those); and indirect effects or third-party externalities from agricultural production and employment, were not addressed in this study. The researcher assumed the agricultural career and technical education program was of the same quality and included the same offerings from 2001 to 2007, the return on investment was able to be calculated for career and technical education programs, federal and state allocations were distributed equally across all programs, and thus completers, and that Rephann's model from his 2008 research study was accurate in projecting the creation of additional labor as the agricultural industry expands.

The population used for this study consisted of 9,145 high school completers of Virginia's agricultural career and technical education programs from 2001 to 2007. The researcher received the data in a Microsoft Excel spreadsheet format from CAEEP, with no means of identifying the respondent; that is, no respondent had any identification number. Each row in the spreadsheet represented the completer's responses to the questions in the post-graduation survey. The data consisted of descriptive information, student perceptions of the agricultural career and technical education program, and his/her current employment status. The completers, representing 97 Virginia school divisions, 94 counties and cities, and 21 planning districts, were predominately white (90.26%), with nearly two-thirds being male. With seven agricultural CTE programs from which to choose, approximately 85% of the students chose to pursue and to complete one of four: *Agricultural Production* (32.29%), *Regular Horticulture* (20.47%), *Agricultural Machinery Service* (16.93%), and *Agricultural Business* (15.19%). Of Virginia's 21 planning districts, greater than 50% of the completers were high school graduates from five districts: Mount Rogers (12.47%), Northern Shenandoah

(11.22%), Richmond Regional (10.78%), West Piedmont (9.21%), and Central Shenandoah (8.92%). Further analysis of the completer data was guided by the five research questions and Kirkpatrick's four levels of evaluation. The rate of return on investment was determined using federal and state funding from the Virginia Department of Education, estimated tax revenues expenditures generated from the incomes of the agriculture career and technical education completers and additional labor generated by an expansion of the agricultural industry.

Conclusions

While the research findings of this study yielded a negative return on investment from the completers of Virginia's agricultural career and technical education program, the study has revealed additional benefits as well as costs that have not been reflected, but should be addressed in future research. According to Baxter (2008), "more than two-thirds of the nation's gross domestic product derives from everyday stuff like dining out, buying a new shirt or visiting the dentist" (¶2). One hundred percent of household income generated from agricultural production would not be expected to be spent solely on agricultural products; other industries would be impacted as well. The purpose of this study was to determine the effect high school completion of the agricultural career and technical education program has on the rate of return on investment by public schools in Virginia. Five research questions were developed to assist the researcher in determining and analyzing the benefits and the costs of the agricultural CTE program to the state of Virginia. The entire research study followed Phillips' conservative approach to conducting ROI analysis in order to "build accuracy and credibility" (Phillips, 2003, p.

220). Conservative costs and benefits were used throughout the study in addressing the five research questions and in exploring Kirkpatrick's levels of evaluation.

Research Question 1

Were students able to find employment related to the agricultural career and technical education program they completed? The research findings revealed that only 5.63% of the completers who responded to employment status were unemployed. Of the completers (9,149) who were employed (5,049), approximately 55.21% had acquired additional education and/or training since high school; 48.82% indicated their work was closely related or somewhat related to their agricultural CTE program; and 47.73% were using most or some of what they had learned in their program in their work. Results of the study suggest the agricultural CTE program has been very successful in preparing completers for future employment and/or additional education.

Research Question 2

What federal and state funding was allocated for students participating in career and technical education programs in the state of Virginia? Federal and state allocations for all of Virginia's career and technical education was $216,461,279 for 2000-07. The federal contribution accounted for 68.98% and the state, 31.02%. Since the allocation for each CTE program was not available, the researcher assumed an equal distribution across all programs and thus, all completers. With a total of 197,199 CTE completers, 9,145 of which were agricultural completers, the assumed total entitlement for the agricultural CTE program was $10,025,375. The inclusion of only federal and state allocations for all of Virgnia's CTE was an inadequate representation of the total cost of the program and should be improved. Such improvement would require the acquisition of the exact dollar

amount federal and state monies allocated to the agricultural CTE program as well as the acquisition of indirect societal or third-party costs.

Research Question 3

Was tax revenue generated by incomes from those who participated in the agricultural career and technical education program? Tax revenue was estimated for two groups of individuals: the agricultural CTE completers and the additional laborers that would be created by industry expansion. The agricultural CTE completers (n = 5,049) and the additional laborers (n = 4,379) produced $123,598,405 in real income, $4,304,745 in income tax revenue, and $8,045,042 in sales tax revenue. The researcher increased the wages 4.54% for those who indicated full-time employment status and 0.49% for those employed part-time. As a result, income tax revenue increased by $15,740 (0.36%), and sales tax revenue increased by $31,541 (0.39%). The projected income and sales tax revenues generated from the completers and additional laborers are believed to be low estimates and not reflective of the total benefits received by Virginia's economy. As suggested in Research Question 3, expanding the ROI model to include indirect societal or third-party benefits would provide a more accurate account of the positive benefit of the agricultural CTE program.

Research Question 4

Did incomes from those who participated in the agricultural career and technical education program vary among statewide planning districts? Analyzing the number of completers and the number of wage-earners per planning district with SPSS and Microsoft Excel revealed considerable variation in the observed frequencies of each group, strong positive correlation between each group, and an indirect measure of success

for each district. The distribution of each group was positively skewed, indicating that the median was less than the mean in each group. A Pearson correlation coefficient (r) of 0.966 ($\alpha = 0.01$) implied a positive relationship between the two variables or groups and indicated that a $r^2 = 0.93$ or 93% of the variability in the number of completers (number of wage-earners) was explained by its relationship with the number of wage-earners (number of completers). Analyzing wage-earners as a percentage of completers provided an indirect measure of success for each district by yielding the percentage of completers finding employment within one year of graduating high school. The percentage of completers who found employment within one year ranged from 23.91% to 50.00%. Table 23 provides the three districts yielding the highest percentage of completers who were wage-earners and the three districts with the lowest percentage. A review of the "wage-earners as a percent of the completers" provided mixed results. That is, those districts producing large numbers of completers did not necessarily have the higher employment rate for completers, suggesting possibly supply and demand factors impacting the respective district.

Research Question 5

Did completion of the high school agricultural career and technical education program produce a return on investment for the Commonwealth of Virginia? The researcher applied Kirkpatrick's four levels of evaluation in deriving the return on investment (ROI) of Virginia's high school agricultural career and technical education program: student reaction, student learning, application of knowledge and skills, and results/impact. While Phillips and Phillips (2005) believed a fifth level is needed for ROI, the researcher concurs with Chapman (2009) in that ROI is implied in level four.

Table 23

Wage-earners as a Percentage of Completers

Planning District	Number of Wage-earners	Number of Completers	Wage-earners as a % of Completers
17-Northern Neck	46	92	50.00%
2-Cumberland Plateau	105	228	46.05%
23-Hampton Roads	128	291	43.99%
:	:	:	:
18-Middle Peninsula	41	157	26.11%
15-Richmond Regional	256	996	25.70%
22-Accomack-Northampton	11	46	23.91%

"The inclusion and relevance of a fifth level is therefore arguably only relevant if the assessment of ROI might otherwise be ignored or forgotten when referring simply to the 'results' level" (Chapman, 2009, p. 5).

Table 24 provides the questions and responses from the post-graduation survey administered to the completers from 2001-07. For level I, *Student Reaction*, results indicated that the completers were satisfied or very satisfied with the preparation they had received from their respective high schools for employment and/or additional education/training. Regarding level II, *Student Learning*, the researcher concluded that "learning" had resulted, since the entire population in the study, 9,145 students, had completed the agricultural CTE program. Responses to survey Questions A, 2.1 and 3.1 provided measures/outcomes for level III, *Application of Knowledge and Skills*. The researcher concluded that the completers had demonstrated the application of their

knowledge and skills from their respective agricultural CTE program by their acknowledgement of their employment and/or completion of additional training and/or

Table 24

Measures/Outcomes for Kirkpatrick's Levels of Evaluation

Evaluation Levels	Measures / Outcomes
I – Student Reaction:	Respondents to survey Question 1.1 (n = 7,012 or 76.68%): • 98.15% were satisfied or very satisfied in high school preparation for employment and/or additional education. Respondents to survey Questions 1.1 and A: • 90.28% (n = 4,558) of those employed (55.21% or n = 5,049) were satisfied or very satisfied in high school preparation for employment. • 93.01% of those in school were satisfied or very satisfied with their preparation for their additional education.
II – Student Learning:	The population of this study, 9,145 high school students, had completed the agricultural CTE program.
III – Application of Knowledge & Skills:	Respondents to survey Question A: • 5,049 were employed. Respondents to survey Question 2.1: • 2,128 indicated held full-time employment. • 1,479 held part-time employment. • 55 held full-time and part-time jobs. • 100 were employed in two or more part-time jobs. Respondents to survey Question 3.1: • Of the 5,049 employed, 65.16% (n = 3,290) had acquired additional training and/or education.
IV – Results (ROI) / Impact:	Completers: ROI = -$0.34 Completers & Additional Labor: ROI = $0.24

education since their high school graduation. Approximately 66.30% (n = 5,049) of those responding to Question A indicated they were employed, with 28.07% enrolled in school and only 5.63% unemployed. Sixty-five percent of those employed had completed additional training and/or education since graduating from high school, with some receiving training and/or education from multiple sources. Lastly, substituting the tax revenue and government expenditures derived from Research Questions 1 – 3 into the formula for the ROI produced a return of -$0.34 for the 2001-07 agricultural CTE completers. While a negative return may appear to be a "waste" to Virginia's taxpayers, one must remember that total benefits (as well as total costs), monetary and non-monetary, were not reflected in the ROI model. Indirect effects or third-party externalities from agricultural production and employment that impact the "quality of life" were not investigated. In addition, the broader benefits of career and technical education were not included. While the agricultural education and the agricultural CTE program may be perceived to be narrowly focused on fulfilling workforce needs, the mission and scope of such education extends beyond meeting the needs of the agricultural industry. According to the Virginia Department of Education, "agricultural education stresses the development of skills in all aspects of agricultural businesses and industries, including planning, management, safety, finances and leadership," skills and concepts that may be applied to other industries as well (VDOE CTE Agriculture, 2010, ¶ 2). The VDOE and the National Council for Agricultural Education seek to produce students (completers) that have the skills and abilities to be life-long learners, enabling them to successfully adjust and adapt to a rapidly changing world. Students are taught to investigate existing problems, to identify the costs and benefits of the situation,

and to develop possible solutions. Achieving such goals and objections within Virginia's agricultural CTE program provide the completers the opportunity to explore employment in fields outside agriculture, as evidenced by a third of the respondents indicating their employment was not related to agriculture. Success of the program is further recognized by 94% of the completers employed in non-agricultural related jobs indicating they were satisfied or very satisfied in the high school program for which they had participated.

To illustrate how indirect benefits may be investigated, the researcher utilized Rephann's 2008 findings to account for the projected generation of additional incomes resulting from industry expansion. According to Rephann (2008), "every job created in agriculture and forestry results in another 1.5 jobs in the Virginia economy, and every dollar generated in value-added results in another $1.75 value-added in the Virginia economy" (p. 1). Applying Rephann's rate of labor expansion to the number of completers who had jobs closely related to agriculture created an additional $57,961,151 in income and an additional $5,790,958 in income tax and sales tax revenues, yielding a ROI of $0.24 for the completers and the additional labor projected to result from industry expansion.

Recommendations

"There is a movement in the public sector to increase accountability of all processes – not only training programs within organization environment, but education programs in academic settings as well as community development programs" (Phillips, 2002, p. vii). The utilization of "return on investment" (ROI) is becoming more commonplace in public education. The use of Kirkpatrick's levels of evaluation and ROI provides the ability to analyze the costs and benefits of all aspects and/or levels of the

academic organization. ROI incorporates conservative measures and/or estimation processes in a clear, concise manner, as was demonstrated throughout this study (Phillips & Phillips, 2005). The following recommendations are provided in an effort to increase the use of Kirkpatrick's levels of evaluation and ROI in not only academia, but more specifically, in all career and technical education programs:

1. While the use of the ROI methodology has increased in the public sector, particularly in training programs, there has been no utilization in agricultural career and technical education programs. Given the current status of the economy and the increased pressure for greater accountability, the researcher recommends the use of ROI in demonstrating the benefits (returns) of career and technical education programs in Virginia and internationally. The ROI methodology should be implemented at all academic levels. For example, CTE regional coordinators should be the first to use ROI in completing their annual follow-up reports. ROI should be completed for each CTE program at that level. If this were done at that level, calculating ROI for each CTE program for the entire state would reflect more accurately each of those respective programs. Had this process been followed from the bottom up, the researcher of this study could have used the true cost of the agricultural CTE program, as opposed, to assuming an equal distribution of government funding across all CTE programs. This may be a weakness of this study in that the number enrolled in the agricultural program was probably smaller than in technology education or trade and industrial education (T & I) and received less than a per student share.

2. With the National Governors Association depending on CTE for improving the educational system and preparing students for future innovation and technological changes, Kirkpatrick's levels of evaluation and ROI should be used to justify the need to require that every secondary student complete a minimum of one CTE course (Wakelyn, 2007) or become a CTE program completer.
3. Since the agricultural industry has the greatest economic impact of any industry in Virginia, greater effort should be directed toward recruiting more students into the agricultural CTE program (Rephann, 2008). According to Myers, Dyer, and Washburn (2005), the nation is facing a shortage of agricultural teachers at the secondary level. The shortage is the result of two few agricultural graduates from institutions of higher education and too many exiting the profession after a short tenure. The researcher recommends that post-secondary institutions increase their recruitment of students into agricultural teacher education programs and secondary institutions investigate ways to improve the retention of agricultural teachers.
4. Since the University of Virginia has now been contracted by the Virginia Department of Education to house the CTE completer survey data collected each year (Pat Oreilly, personal communication, April 8, 2010), it is an opportune time to revisit the survey instrument. There are a number of improvements that could be made to provide researchers with information that would better reflect the true benefits and costs of the program. While the researcher recommends the following changes to the survey, he stresses that the entire survey instrument

should be reviewed by a committee as before, but with the addition of industry representation as well:

- Question 2.6, "How much does your job pay before taxes?" – the intervals of hourly wage in the choices should be annual income and should be equal in size. Equal intervals would improve statistical analyses. Also, the minimum wage has changed.
- Question A, "Which best describes you?," and Question 2.1, "Which best describes your current employment?" should be combined into one question. Having one employment question would yield only one employment value, as opposed, to two.
- Questions using Likert scales with only three or four values should be expanded. Additional choices would increase the reliability in the data obtained from the respondents.

5. In an effort to account for the total costs of infrastructure and staffing specific to agricultural education, as described in the research limitations, the researcher recommends that one school district provides all of the aforementioned costs as a part of a pilot exercise in improving the ROI model. Addressing recommendations 4 and 5 would improve validity and reliability of the survey instrument and of the model.
6. To account for other indirect benefits and costs (third-party externalities), the ROI model should include the indirect benefits and costs derived from an input-output analysis, as was used in Rephann's study in 2008.

7. Monetary returns for education are not a one-time benefit; benefits are ongoing. Future projections could be improved if the completers were surveyed five years after completion of their respective agricultural programs.
8. The measurement of benefits from actual agricultural education received by the completer could be improved if greater focus was placed on improving the survey response of employers of the completers. While the respective school divisions have attempted to survey the employers, the survey response rate has been too low to draw any conclusions.

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APPENDICES

Appendix A

CTE Completer Survey

A. Which best describes you? Select the best description of your current education/career status.

- o Employed and in school → (Complete Sections 1, 2, and 3)
- o ONLY employed → (Complete Questions B and Sections 1 and 2)
- o ONLY in school → (Complete Sections 1 and 3)
- o Homemaker → (Complete Question B and Section 1)
- o Homemaker and in school → (Complete sections 1 and 3)
- o Military → (Complete Question B and Section 1)
- o Unemployed and not in school → (Complete Question B and Sections 1 and 4)

B. If you are not currently in school, have you received training or any other education since high school?

- o Yes → (Complete Question 3.1 in addition to the sections noted in Question A)
- o No → (Complete sections noted in Question A)
- o Currently in school → (Complete sections noted in Question A)

Section 1 All Respondents

1.1 Overall, how satisfied are you with the preparation you received at <<School_Name>> for employment and/or further education?

o Very Satisfied o Satisfied o Dissatisfied o Very Dissatisfied

1.2 In the following areas, rate how satisfied you are with the preparation you received at <<School_Name>> for employment and/or further education.

	Very Satisfied	Satisfied	Dissatisfied	Very Dissatisfied
Reading Skills	o	o	o	o
Math Skills	o	o	o	o
Writing Skills	o	o	o	o
Speaking and Listening Skills	o	o	o	o
Computer Literacy Skills	o	o	o	o
Reasoning, Problem Solving, Decision Making Skills	o	o	o	o
Technical Skills of your <<Alias>> program	o	o	o	o

Appendix A

CTE Completer Survey

1.3 Did you receive an industry, occupational or professional certification or license as a result of completing the <<Alias>> program?

o Yes o No

1.4 Are you currently working to obtain an industry, occupational or professional certification or license?

o Yes o No

Section 2 Employment

2.1 Which best describes your current employment?

o Full-time Job (≥ 30 hrs per week in one job) o Full-time & Part-time Job

o Part-time Job (less than 30 hrs per week) o 2 or More Part-time Jobs

2.2 To what extent is your work related to the <<Alias>> program you completed at <<School_Name>>?

o Closely Related o Somewhat Related o Not Related

2.3 How much of what you learned in your <<Alias>> courses are you using for your job?

o Most o Some o Little o None

2.4 Overall, how satisfied are you with your job?

o Satisfied o Dissatisfied

2.5 Please rate the following aspects of your job:

	Satisfied	Dissatisfied	No Opinion
Benefit Package (health insurance, paid vacation, retirement plan)	o	o	o
Potential for Advancement	o	o	o

2.6 How much does your job pay before taxes?

o < $6.00/hr o $6.00 to $8.99/hr o $9.00 to $12.00/hr o > $12.00/hr

Section 3 Continuing Education and Training

3.1 Check all the types of education you have participated in since high school.

	Part-time	Full-time
Community College	o	o
Four-Year University	o	o
Technical School/College	o	o
Registered Apprenticeship	o	o
Occupational/Technical Training through a Local School System	o	o
Business/Industry Training through your Employer	o	o
Other	o	o

3.2 To what extent is your area of study related to the <<Alias>> program you completed at <<School_Name>>?

o Closely Related o Somewhat Related o Not Related

3.3 Please check all the courses in which you have enrolled in SINCE high school.

	Developmental	Entry Level	Advanced
Mathematics	o	o	o
English/Language Arts/Speech	o	o	o
Science	o	o	o

Section 4 Unemployment

4.1 Which best describes your situation?

o Unemployed now but have been employed since high school
o Unemployed since high school

4.2 Which best describes why you are currently unemployed?

o Waiting to enter the military
o No jobs available in my community
o No jobs available related to my <<Alias>> program
o Lack the academic skills to get a job
o Lack technical skills to get a job
o Do not desire employment

Appendix B

Seventh through Eighth Grade Enrollment by Planning District, District Identification Number, and Graduation Year

Planning District		2001	2002	2003	2004	2005	2006	2007	Total
1-Lenowisco	*n*	6,943	7,663	6,868	6,824	6,860	6,848	6,927	48,933
	%	1.30	1.40	1.22	1.19	1.17	1.15	1.16	1.22
2-Cumberland Plateau	*n*	8,354	8,036	8,052	7,915	7,924	7,952	7,950	56,183
	%	1.56	1.47	1.43	1.38	1.35	1.34	1.33	1.41
3-Mount Rogers	*n*	12,551	12,481	12,729	12,847	12,855	12,955	12,942	89,360
	%	2.35	2.28	2.27	2.23	2.19	2.18	2.16	2.24
4-New River Valley	*n*	9,177	9,300	9,463	9,522	9,552	9,612	9,640	66,266
	%	1.72	1.70	1.69	1.66	1.63	1.62	1.61	1.66
5-Roanoke Valley-Alleghany Regional	*n*	17,664	18,013	18,307	18,576	18,891	19,077	19,193	129,721
	%	3.31	3.30	3.26	3.23	3.22	3.22	3.21	3.25
6-Central Shenandoah	*n*	16,769	16,977	17,176	17,372	17,511	17,839	17,998	121,642
	%	3.14	3.11	3.06	3.02	2.99	3.01	3.01	3.04
7-Northern Shenandoah Valley	*n*	13,318	15,397	14,176	14,711	15,262	15,699	16,104	104,667
	%	2.49	2.82	2.52	2.56	2.60	2.65	2.69	2.62
8-Northern Virginia	*n*	126,374	131,002	136,222	140,838	144,383	145,920	148,181	972,920
	%	23.65	23.98	24.26	24.48	24.62	24.60	24.77	24.35
9-Rappahannock-Rapiden	*n*	10,255	10,363	10,749	11,081	11,584	11,933	12,289	78,254
	%	1.92	1.90	1.91	1.93	1.98	2.01	2.05	1.96
10-Thomas Jefferson	*n*	12,826	13,036	13,389	13,619	13,809	13,871	13,993	94,543
	%	2.40	2.39	2.38	2.37	2.35	2.34	2.34	2.37

Appendix B (continued)

Planning District		2001	2002	2003	2004	2005	2006	2007	Total
11-Region 2000	*n*	16,365	16,431	16,710	16,725	16,818	16,848	16,922	116,819
	%	3.06	3.01	2.98	2.91	2.87	2.84	2.83	2.92
12-West Piedmont	*n*	17,357	17,461	17,596	17,507	17,376	17,121	17,016	121,434
	%	3.25	3.20	3.13	3.04	2.96	2.89	2.84	3.04
13-Southside	*n*	5,916	5,928	5,945	5,915	6,009	6,056	6,043	41,812
	%	1.11	1.09	1.06	1.03	1.02	1.02	1.01	1.05
14-Commonwealth Regional	*n*	6,532	6,589	6,781	6,827	6,913	6,924	6,888	47,454
	%	1.22	1.21	1.21	1.19	1.18	1.17	1.15	1.19
15-Richmond Regional	*n*	63,015	65,328	67,082	69,603	71,634	73,057	74,478	484,197
	%	11.79	11.96	11.95	12.10	12.21	12.32	12.45	12.12
16-George Washington Regional	*n*	22,148	23,462	24,955	26,048	27,231	28,571	29,194	181,609
	%	4.15	4.30	4.44	4.53	4.64	4.82	4.88	4.55
17-Northern Neck	*n*	4,295	3,270	3,233	3,282	3,212	3,213	3,186	23,691
	%	0.80	0.60	0.58	0.57	0.55	0.54	0.53	0.59
18-Middle Peninsula	*n*	6,737	6,737	6,832	6,782	6,802	6,867	6,887	47,644
	%	1.26	1.23	1.22	1.18	1.16	1.16	1.15	1.19
19-Crater	*n*	34,025	36,217	37,020	38,318	39,256	39,688	40,227	264,751
	%	6.37	6.63	6.59	6.66	6.69	6.69	6.72	6.63
22-Accomack-Northampton	*n*	3,394	3,446	3,533	3,531	3,466	3,523	3,382	24,275
	%	0.64	0.63	0.63	0.61	0.59	0.59	0.57	0.61

Appendix B (continued)

Planning District		2001	2002	2003	2004	2005	2006	2007	Total
23-Hampton Roads	*n*	120,270	119,101	124,621	127,419	129,144	129,530	128,745	878,830
	%	22.51	21.80	22.20	22.15	22.02	21.84	21.52	22.00
Total		534,285	546,238	561,439	575,262	586,492	593,104	598,185	3,995,005

From "Total School Fall Enrollment: Grades 7-12 by Year," by Governor's Office for Substance Abuse. 2010. Retrieved February 8, 2010 from http://www.data.gosap.governor.virginia.gov/GOSAP_App/Indicator.aspx?format=HTML4.0&report=/GOSAP/Indicators+List+1&indicator_class=3&indicator_id=175&yearFrom=2001&yearTo=2007&year=2007&radDimension=county_name&measure=total&county_name=51015,51017,51530,51660,51091,51678,51163,51165,51790,51820&zipcode=&age_name=&gender_name=&race_name=&dim1=county_name&dim2=&dim3=&dim4=&dim5=.

Appendix C

Income and Tax Revenues for Female Completers

	00-01	01-02	02-03	03-04	04-05	05-06	06-07
Income:							
Nominal Income:	1,077,358	1,434,478	1,406,239	1,699,410	1,924,602	1,767,230	1,882,500
2009 Adjustment:	1.21	1.19	1.17	1.14	1.10	1.05	1.03
Real Income:	1,303,603	1,707,028	1,645,300	1,937,327	2,117,062	1,855,591	1,938,975
Tax Rates:							
Income before Taxes:	12,029	11,573	9,773	9,906	10,741	12,335	13,040
Income after Taxes:	11,557	11,253	9,488	9,667	10,505	11,937	12,535
Income Tax Rate:	0.0392	0.0277	0.0292	0.0241	0.0220	0.0323	0.0387
Tax Revenues:							
Nominal Tax Revenues:	42,274	39,664	41,009	41,001	42,287	57,021	72,904
2009 Adjustment:	1.21	1.19	1.17	1.14	1.10	1.05	1.03
Real Tax Revenues:	51,151	47,200	47,980	46,741	46,516	59,872	75,091

From "Consumer Expenditure Survey: Cross-tabulated Tables," by Bureau of Labor Statistics. 2009. Retrieved from http://www.bls. gov/cex/csxcross.htm#y20001.

Appendix D

Income and Tax Revenues for Male Completers

	00-01	01-02	02-03	03-04	04-05	05-06	06-07
Income:							
Nominal Income:	5,862,430	5,647,634	6,419,273	6,576,367	7,708,456	7,501,392	7,723,082
2009 Adjustment:	1.21	1.19	1.17	1.14	1.10	1.05	1.03
Real Income:	7,093,540	6,720,684	7,510,549	7,497,058	8,479,301	7,876,461	7,954,774
Tax Rates:							
Income before Taxes:	12,168	12,557	13,014	13,285	13,680	15,043	16,328
Income after Taxes:	11,589	12,068	12,460	12,825	13,313	14,650	15,745
Income Tax Rate:	0.0476	0.0389	0.0426	0.0346	0.0268	0.0261	0.0357
Tax Revenues:							
Nominal Tax Revenues:	278,957	219,933	273,265	227,710	206,798	195,975	275,757
2009 Adjustment:	1.21	1.19	1.17	1.14	1.10	1.06	1.03
Real Tax Revenues:	337,538	261,720	319,721	259,590	227,478	207,733	284,029

From "Consumer Expenditure Survey: Cross-tabulated Tables," by Bureau of Labor Statistics. 2009. Retrieved from http://www.bls.Govcex/csxcross.htm#y20001.

Appendix E

Consumer Expenditures and Sales Tax Revenues for Female Completers

	00-01	01-02	02-03	03-04	04-05	05-06	06-07
Nominal Income:	1,077,358	1,434,478	1,406,239	1,699,410	1,924,602	1,767,230	1,882,500
Nominal Consumption:	1,371,484	1,932,262	2,166,843	2,546,027	2,763,177	2,449,480	2,744,927
2009 Adjustment:	1.21	1.19	1.17	1.14	1.10	1.05	1.03
Real Consumption:	1,659,495	2,299,392	2,535,206	2,902,470	3,039,495	2,571,954	2,827,275
Income before Taxes:	12,029	11,573	9,773	9,906	10,741	12,335	13,040
AVG Consumer Expenditures:	15,313	15,589	15,059	14,841	15,421	17,097	19,014
AVG Propensity to Consume:	1.27	1.35	1.54	1.50	1.44	1.39	1.46
Sales Tax Rate:	0.045	0.05	0.05	0.05	0.05	0.05	0.05
Nominal Sales Tax Revenues:	61,717	96,613	108,342	127,301	138,159	122,474	137,246
2009 Adjustment:	1.21	1.19	1.17	1.14	1.10	1.05	1.03
Real Sales Tax Revenues:	74,677	114,970	126,760	145,124	151,975	128,598	141,364

From "Consumer Expenditure Survey: Cross-tabulated Tables," by Bureau of Labor Statistics. 2009. Retrieved from http://www.bls.gov/cex/csxcross.htm#y20001.

Appendix F

Consumer Expenditures and Sales Tax Revenues for Male Completers

	00-01	01-02	02-03	03-04	04-05	05-06	06-07
Nominal Income:	5,862,430	5,647,634	6,419,273	6,576,367	7,708,456	7,501,392	7,723,082
Nominal Consumption:	8,316,190	7,877,992	8,308,948	8,651,994	10,249,203	8,928,566	9,034,700
2009 Adjustment:	1.21	1.19	1.17	1.14	1.10	1.06	1.03
Real Consumption:	10,062,590	9,374,811	9,721,469	9,863,273	11,274,123	9,374,994	9,305,741
Income before Taxes:	12,168	12,557	13,014	13,285	13,680	15,043	16,328
AVG Consumer Expenditures:	17,261	17,516	16,845	17,478	18,189	17,905	19,101
AVG Propensity to Consume:	1.42	1.39	1.29	1.32	1.33	1.19	1.17
Sales Tax Rate:	0.045	0.05	0.05	0.05	0.05	0.05	0.05
Nominal Sales Tax Revenues:	374,229	393,900	415,447	432,600	512,460	446,428	451,735
2009 Adjustment:	1.21	1.19	1.17	1.14	1.10	1.06	1.03
Real Sales Tax Revenues:	452,817	468,741	486,073	493,164	563,706	473,214	465,287

From "Consumer Expenditure Survey: Cross-tabulated Tables," by Bureau of Labor Statistics. 2009. Retrieved from http://www.bls.gov/cex/csxcross.htm#y20001.

Appendix G

Income and Tax Revenues for Additional Female Laborers

	00-01	01-02	02-03	03-04	04-05	05-06	06-07
Income:							
Nominal Income:	754,500	948,480	809,400	843,600	1,164,330	1,031,118	1,098,195
2009 Adjustment:	1.21	1.19	1.17	1.14	1.10	1.05	1.03
Real Income:	912,945	1,128,691	946,998	961,704	1,280,763	1,082,674	1,131,141
Tax Rates:							
Income before Taxes:	12,029	11,573	9,773	9,906	10,741	12,335	13,040
Income after Taxes:	11,557	11,253	9,488	9,667	10,505	11,937	12,535
Income Tax Rate:	0.0392	0.0277	0.0292	0.0241	0.0220	0.0323	0.0387
Tax Revenues:							
Nominal Tax Revenues:	29,605	26,226	23,604	20,353	25,583	33,270	42,530
2009 Adjustment:	1.21	1.19	1.17	1.14	1.10	1.05	1.03
Real Tax Revenues:	35,823	31,209	27,616	23,203	28,141	34,933	43,806

From "Consumer Expenditure Survey: Cross-tabulated Tables," by Bureau of Labor Statistics. 2009. Retrieved from http://www.bls.gov/cex/csxcross.htm#y2001.

Appendix H

Income and Tax Revenues for Additional Male Laborers

	00-01	01-02	02-03	03-04	04-05	05-06	06-07
Income:							
Nominal Income:	5,436,000	5,621,400	6,507,060	5,617,425	7,367,025	7,066,045	7,484,475
2009 Adjustment:	1.21	1.19	1.17	1.14	1.10	1.05	1.03
Real Income:	6,577,560	6,689,466	7,613,260	6,403,865	8,103,728	7,419,347	7,709,009
Tax Rates:							
Income before Taxes:	12,168	12,557	13,014	13,285	13,680	15,043	16,328
Income after Taxes:	11,589	12,068	12,460	12,825	13,313	14,650	15,745
Income Tax Rate:	0.0476	0.0389	0.0426	0.0346	0.0268	0.0261	0.0357
Tax Revenues:							
Nominal Tax Revenues:	258,666	218,911	277,003	194,506	197,639	184,601	267,237
2009 Adjustment:	1.21	1.19	1.17	1.14	1.10	1.06	1.03
Real Tax Revenues:	312,985	260,504	324,093	221,737	217,403	195,677	275,254

From "Consumer Expenditure Survey: Cross-tabulated Tables," by Bureau of Labor Statistics. 2009. Retrieved from http://www.bls. gov/cex/csxcross.htm#y20001.

Appendix I

Consumer Expenditures and Sales Tax Revenues for Additional Female Laborers

	00-01	01-02	02-03	03-04	04-05	05-06	06-07
Nominal Income:	754,500	948,480	809,400	843,600	1,164,330	1,031,118	1,098,195
Nominal Consumption:	960,484	1,277,616	1,247,187	1,263,867	1,671,644	1,429,188	1,601,310
2009 Adjustment:	1.21	1.19	1.17	1.14	1.10	1.05	1.03
Real Consumption:	1,162,185	1,520,364	1,459,208	1,440,809	1,838,809	1,500,647	1,649,349
Income before Taxes:	12,029	11,573	9,773	9,906	10,741	12,335	13,040
AVG Consumer Expenditures:	15,313	15,589	15,059	14,841	15,421	17,097	19,014
AVG Propensity to Consume:	1.27	1.35	1.54	1.50	1.44	1.39	1.46
Sales Tax Rate:	0.045	0.05	0.05	0.05	0.05	0.05	0.05
Nominal Sales Tax Revenues:	43,222	63,881	62,359	63,193	83,582	71,459	80,065
2009 Adjustment:	1.21	1.19	1.17	1.14	1.10	1.05	1.03
Real Sales Tax Revenues:	52,298	76,018	72,960	72,040	91,940	75,032	82,467

From "Consumer Expenditure Survey: Cross-tabulated Tables," by Bureau of Labor Statistics. 2009. Retrieved from http://www.bls.gov/cex/csxcross.htm#y20001.

Appendix J

Consumer Expenditures and Sales Tax Revenues for Additional Male Laborers

	00-01	01-02	02-03	03-04	04-05	05-06	06-07
Nominal Income:	5,436,000	5,621,400	6,507,060	5,617,425	7,367,025	7,066,045	7,484,475
Nominal Consumption:	7,711,275	7,841,399	8,422,578	7,390,392	9,795,235	8,410,393	8,755,571
2009 Adjustment:	1.21	1.19	1.17	1.14	1.10	1.05	1.03
Real Consumption:	9,330,643	9,331,264	9,854,416	8,425,047	10,774,759	8,830,912	9,018,238
Income before Taxes:	12,168	12,557	13,014	13,285	13,680	15,043	16,328
AVG Consumer Expenditures:	17,261	17,516	16,845	17,478	18,189	17,905	19,101
AVG Propensity to Consume:	1.42	1.39	1.29	1.32	1.33	1.19	1.17
Sales Tax Rate:	0.045	0.05	0.05	0.05	0.05	0.05	0.05
Nominal Sales Tax Revenues:	347,007	392,070	421,129	369,520	489,762	420,520	437,779
2009 Adjustment:	1.21	1.19	1.17	1.14	1.10	1.06	1.03
Real Sales Tax Revenues:	419,879	466,563	492,721	421,252	538,738	445,751	450,912

From "Consumer Expenditure Survey: Cross-tabulated Tables," by Bureau of Labor Statistics. 2009. Retrieved from http://www.bls.gov/cex/csxcross.htm#y20001.

Appendix K

Additional Income and Tax Revenues for Female Completers who Acquired Additional Education and/or Training

	00-01	01-02	02-03	03-04	04-05	05-06	06-07
Income:							
Nominal Income:	8,432	16,094	13,767	21,151	0	0	17,947
2009 Adjustment:	1.21	1.19	1.17	1.14	1.1	1.05	1.03
Real Income:	10,203	19,152	16,107	24,112	0	0	18,485
Tax Rates:							
Income before Taxes:	12,029	11,573	9,773	9,906	10,741	12,335	13,040
Income after Taxes:	11,557	11,253	9,488	9,667	10,505	11,937	12,535
Income Tax Rate:	0.0392	0.0277	0.0292	0.0241	0.0220	0.0323	0.0387
Tax Revenues:							
Nominal Tax Revenues:	331	445	401	510	0	0	695
2009 Adjustment:	0.0215	0.01	0.0063	0.0049	0.0077	0.0086	0.0048
Real Tax Revenues:	400	530	470	582	0	0	716

From "Consumer Expenditure Survey: Cross-tabulated Tables," by Bureau of Labor Statistics. 2009. Retrieved from http://www.bls. gov/cex/csxcross.htm#y20001.

Appendix L

Additional Income and Tax Revenues for Male Completers who Acquired Additional Education and/or Training

	00-01	01-02	02-03	03-04	04-05	05-06	06-07
Income:							
Nominal Income:	49,197	53,275	50,986	65,974	0	0	70,636
2009 Adjustment:	1.21	1.19	1.17	1.14	1.1	1.05	1.03
Real Income:	59,529	63,398	59,653	75,211	0	0	72,755
Tax Rates:							
Income before Taxes:	12,168	12,557	13,014	13,285	13,680	15,043	16,328
Income after Taxes:	11,589	12,068	12,460	12,825	13,313	14,650	15,745
Income Tax Rate:	0.0476	0.0389	0.0426	0.0346	0.0268	0.0261	0.0357
Tax Revenues:							
Nominal Tax Revenues:	2,341	2,075	2,170	2,284	0	0	2,522
2009 Adjustment:	1.21	1.19	1.17	1.14	1.10	1.06	1.03
Real Tax Revenues:	2,833	2,469	2,539	2,604	0	0	2,598

From "Consumer Expenditure Survey: Cross-tabulated Tables," by Bureau of Labor Statistics. 2009. Retrieved from http://www.bls. gov/cex/csxcross.htm#y20001.

Appendix M

Consumer Expenditures and Sales Tax Revenues for Female Completers who Acquired Additional Education and/or Training

	00-01	01-02	02-03	03-04	04-05	05-06	06-07
Nominal Income:	10,203	19,152	16,107	24,112	0	0	18,485
Nominal Consumption:	12,988	25,798	24,819	36,124	0	0	26,954
2009 Adjustment:	1.21	1.19	1.17	1.14	1.10	1.05	1.03
Real Consumption:	15,716	30,699	29,039	41,181	0	0	27,763
Income before Taxes:	12,029	11,573	9,773	9,906	10,741	12,335	13,040
AVG Consumer Expenditures:	15,313	15,589	15,059	14,841	15,421	17,097	19,014
AVG Propensity to Consume:	1.27	1.35	1.54	1.50	1.44	1.39	1.46
Sales Tax Rate:	0.045	0.05	0.05	0.05	0.05	0.05	0.05
Nominal Sales Tax Revenues:	584	1,290	1,241	1,806	0	0	1,348
2009 Adjustment:	1.21	1.19	1.17	1.14	1.10	1.05	1.03
Real Sales Tax Revenues:	707	1,535	1,452	2,059	0	0	1,388

From "Consumer Expenditure Survey: Cross-tabulated Tables," by Bureau of Labor Statistics. 2009. Retrieved from http://www.bls.gov/cex/csxcross.htm#y20001.

Appendix N

Consumer Expenditures and Sales Tax Revenues for Male Completers who Acquired Additional Education and/or Training

	00-01	01-02	02-03	03-04	04-05	05-06	06-07
Nominal Income:	59,529	63,398	59,653	75,211	0	0	72,755
Nominal Consumption:	84,445	88,435	77,214	98,948	0	0	85,111
2009 Adjustment:	1.21	1.19	1.17	1.14	1.10	1.05	1.03
Real Consumption:	102,178	105,237	90,340	112,801	0	0	87,664
Income before Taxes:	12,168	12,557	13,014	13,285	13,680	15,043	16,328
AVG Consumer Expenditures:	17,261	17,516	16,845	17,478	18,189	17,905	19,101
AVG Propensity to Consume:	1.42	1.39	1.29	1.32	1.33	1.19	1.17
Sales Tax Rate:	0.045	0.05	0.05	0.05	0.05	0.05	0.05
Nominal Sales Tax Revenues:	3,800	4,422	3,861	4,947	0	0	4,256
2009 Adjustment:	1.21	1.19	1.17	1.14	1.10	1.05	1.03
Real Sales Tax Revenues:	4,598	5,262	4,517	5,640	0	0	4,383

From "Consumer Expenditure Survey: Cross-tabulated Tables," by Bureau of Labor Statistics. 2009. Retrieved from http://www.bls.gov/cex/csxcross.htm#y20001.

VITA

P. Scott Bevins

Work Address
The University of Virginia's College at Wise
1 College Avenue
Wise, VA 24293
(276) 376-1066
pb8q@uvawise.edu

Home Address
1759 Holton Ave. East
Big Stone Gap, VA 24219
(276) 523-3746

Education

- Ph.D., Education, Occupational and Technical Studies Concentration, Old Dominion University, Norfolk, Virginia, May 2010.
- M.S., Agricultural Economics, University of Tennessee, Knoxville, Tennessee, August 1991.
- B.S., Mathematics, The University of Virginia's College at Wise, Wise, Virginia, May 1985.
  B.S., Business Administration, Economics Concentration, The University of Virginia's College at Wise, Wise, Virginia, May 1985.

Experience

- Director of Institutional Research, The University of Virginia's College at Wise, Wise, Virginia, August 2007 - Present.
- Director of External Programs & Institutional Research, The University of Virginia's College at Wise, Wise, Virginia, July 2005 – August 2007.
- Director of Institutional Research & Associate Registrar, The University of Virginia's College at Wise, Wise, Virginia, August 2003 – July 2005.
- Director of Institutional Research, The University of Virginia's College at Wise, Wise, Virginia, July 2001 – August 2003.

Presentations

- Ritz, J. & Beving, S. (2010, March). *Workforce Need for Technology and Engineering Education.* Presented at the International Technology Education Association Conference, Charlotte, North Carolina.
- Ritz, J. & Beving, S. (2009, March). *Proving the Worth of Technology Education in Stem.* Presented at the International Technology Education Association Conference, Louisville, Kentucky.
- Bevins, S. (2008, June). *Aquaculture: From the Classroom to the Market.* Presented at the Pan-Pacific Business Conference, XXV, San Jose, Costa Rica.
- Bevins, S. & Stratton, G. (1999, April). *Earth Friendly Economics: A Sustainable Development Curriculum for the Classroom.* Presented at the International Conference on Effective Strategies in Economics and Business Education, Glasgow, Scotland.
- Bevins, S. & Yun, P. (1989, May). *An Economic Analysis of Sea Transportation Costs in the Pacific Coal Market.* Presented at the Pan-Pacific Business Conference VI, Sydney, Australia.

Publications

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Professional Organizational Memberships

- Member of the International Technology and Engineering Educators Association (ITEEA)

- Member of the Association of Institutional Research (AIR)

- Member of the Virginia Association for Management, Analysis, and Planning (VAMAP)

Honors

- May 2010, Old Dominion University 2008-2009 Outstanding Technology Education Graduate Student Award

- March 2010, Donald Maley Spirit of Excellence – Outstanding Graduate Student Citation

- May 2009, Harrison award for "*Outstanding Instructional Support*," UVa-Wise's 2008-09.

- Faculty Member of the Year, Mountain Empire Community College, Big Stone Gap, VA, 1997-98.

- Outstanding Achievement in Economics, University of Virginia's College at Wise, Wise, VA, 1989.

References

Dr. John M. Ritz
Graduate Program Director
Old Dominion University
Darden College of Education
228 Education Building
Norfolk, VA 23529
(757) 683-5226

Dr. David Prior
Chancellor
UVA's College at Wise
One College at Wise
Wise, VA 24293
(276) 328-0122

Dr. Gilmer W. Blackburn
Provost & Senior Vice Chancellor
UVA's College at Wise
One College Avenue
Wise, VA 24293
(276) 328-0120

Dr. Robert Sandel
President
Virginia Western CC
3095 Colonial Avenue SW
Roanoke, VA 24015
(540) 857-7231